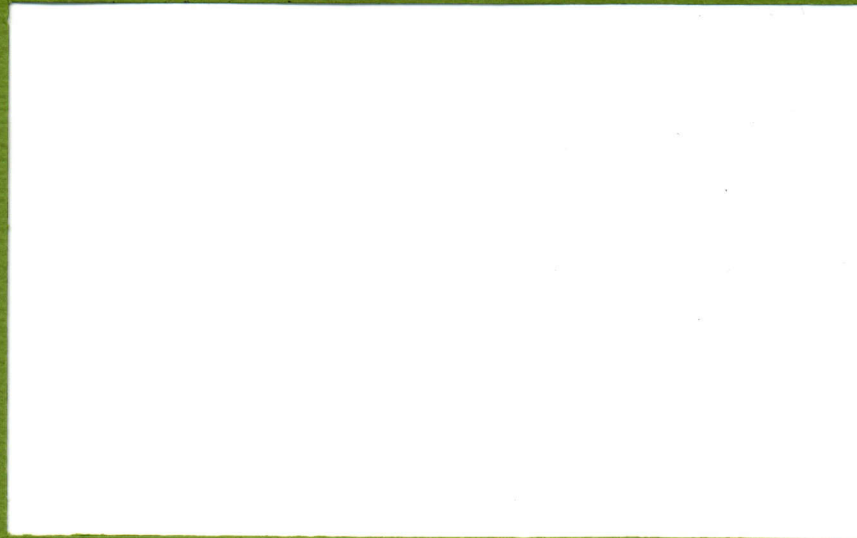


Department of Psychology



University of South Florida
Tampa, Florida 33620

LOWER SOUTHEAST FLORIDA
HURRICANE EVACUATION STUDY

Carnot E. Nelson, Ph.D.
Carol Crumley
Barbara Fritzsche
Brian Adcock

University of South Florida
Department of Psychology

U. S. Army Corps of Engineers
Jacksonville District Office
P. O. Box 4970
Jacksonville, Florida 32232-0019

October, 1989

AV554.5.F6 N62 1989

TABLE OF CONTENTS

Executive Summary	1
Introduction	7
REVIEW OF ACTUAL HURRICANE EXPERIENCE.	7
Methodological Concerns.	8
Analytical Concerns	14
Research Especially Relevant to Southeast Florida	17
Evacuation Rates	18
Type of Refuge	24
Local Versus Long Distance Travel	24
Time to Evacuate	28
REVIEW OF BEHAVIORAL STUDIES	31
Review of Results	35
Comparison of Results of Behavioral Studies to Actual Hurricane Evacuation Behavior	45
REVIEW OF IMMIGRANT POPULATIONS	49
Literature Review	49
Responses of Interviewees in Southeast Florida	54
Hurricane Preparedness	54
Disaster Response	58
Special County Problems	62
Future Research	63
MONROE COUNTY BEHAVIORAL ANALYSIS	66
Methodology	68
RESULTS	69
Sample Size and Confidence Interval	69
Confidence Intervals for Various Sample Size	70

TABLE OF CONTENTS (Continued)

Order Effects	71
Type of Housing	71
Evacuation Rates	71
Total Evacuation Rates by Household	72
Evacuation Timing	73
Type of Refuge	82
Destination and Routes	83
Vehicle Use	84
CONCLUSION	93
References	96
APPENDIX A	101
APPENDIX B	103
APPENDIX C	110

LOWER SOUTHEAST FLORIDA HURRICANE EVACUATION STUDY

Executive Summary

Four major sections comprise this report. These sections are: (1) a review of studies of actual hurricane evacuations, (2) a review of behavioral studies of reactions to hypothetical hurricanes, (3) a review of the literature regarding the responses of immigrant groups to evacuations as well as a summary of the results of interviews with persons knowledgeable about various immigrant groups in Southeast Florida regarding issues of importance to emergency managers, and finally (4) a behavioral study of reactions to hypothetical hurricanes of residents of Monroe County.

In the review of studies of actual hurricane evacuations, the following methodological issues surfaced. These issues cast doubt on whether or not the results can be generalized to other populations and areas.

1. The vulnerability of the residences of the respondents has either not been specified or is unclear.
2. "Shadow evacuation," the evacuation of people not needing to evacuate, has only been examined in one study.
3. Few studies have examined hurricane evacuation in a large urban metropolitan area.
4. The demographic characteristics of the areas which have been studied are vastly different.
5. The number of respondents sampled has been too small to draw any conclusions.
6. The behavior of mobile home residents has only been

examined in one study, and the type of housing of the respondents is often not specified.

7. Finally, the time between the evacuation and the survey varies widely and people may forget details such as when they left their homes.

In addition, the data analysis techniques that have typically been used in evacuation research lack the sophistication necessary to adequately describe a complex process. Multivariate, rather than simple univariate techniques, need to be used if adequate models of evacuation behavior are to be developed and tested.

The results of studies of actual hurricane evacuation behavior, methodological issues aside, point to a few general conclusions.

1. The more vulnerable the area, the higher the evacuation rate.
2. The evacuation rates of coastal mainland have been low enough to warrant the attention of emergency managers.
3. There was wide variability in the evacuation rates between the various studies. These differences were probably caused by the actions of local officials in terms of whether an evacuation was ordered or not.
4. There was wide variation in the use of public shelters with no consistent predictors of shelter use.
5. Inconsistencies in the definition made comparisons with regard to "out of town" travel impossible.
6. Studies on the amount of time between notification and

actual evacuation typically show a sharp increase in evacuation behavior immediately after respondents were notified to leave.

Large scale studies which use sophisticated analytic techniques should be conducted after every major evacuation so that the potential that actual hurricane evacuation data has in predicting future behavior can be fully exploited.

A review of behavioral surveys, studies of what respondents' behavior would be to hypothetical situations, also indicated a number of methodological issues which can reduce the validity of these studies.

1. There is the general problem endemic to all survey research; namely, will people do what they say they will do?
2. The sampling strategy for all behavioral surveys must either stratify by vulnerability area or compare ex post facto the responses in terms of vulnerability.
3. Behavioral studies need to be conducted on a regular basis because of growth and demographic changes in vulnerable areas. In addition, historical events (e.g. actual hurricanes in the area or other areas) may change how respondents will react.
4. Studies need to be conducted on the potential responses of mobile home residents and persons not living in vulnerable areas.

The review of the results of behavioral studies leads to the following conclusions:

1. With the exception of Southeast Florida, practically all people indicate they would evacuate if so ordered.
2. There is wide variation in the percentage of persons who state they would use public shelters. Behavioral surveys tend to overpredict actual shelter usage, but, how much and when they overpredict is uncertain.
3. There is also a wide variation in the percentage of evacuees who plan to leave their home county. If there are safe havens in one's area, people will probably be less likely to travel long distances.
4. The data on when evacuees plan to leave cannot be compared between studies because the question has been asked in a variety of different ways.

There is virtually no literature on the differences among racial and ethnic minorities in evacuation behavior. However, the few studies that have been conducted indicate that 1) there are differences in the way various minority groups respond to emergencies and 2) the media, especially ethnic media, are important mechanisms for disseminating emergency information. These tentative conclusions were reinforced when key informants were interviewed about the hurricane preparedness and probable response of various ethnic groups.

1. For both Haitians and Hispanics, the ethnic media was indicated as an important source of information for both educating the population and as a source of evacuation information.
2. The respondents indicated that with the possible exception

of Haitians, ethnic group members would probably be less likely to use public shelters than would the general population. Where Haitians are encouraged to go and whether they have friends or relatives in the area will probably influence the type of shelter these individuals seek.

3. More research certainly needs to be conducted on the response of minority groups to hurricanes.

The behavioral study of residents in Monroe County indicated the following:

1. For both Category II and Category III storms, there would be a higher evacuation rate in the Upper and Middle Keys than in the Lower Keys. In a Category II storm only 43 percent of the Lower Key respondents would evacuate and in a Category III storm this increased to 56 percent.
2. Almost one-half of the respondents plan to leave within a few hours after a 36 hour notice.
3. Residents of the Lower Keys (32%) were more likely to indicate they would go to a public shelter than either residents of the Middle Keys (16%) or Upper Keys (5%).
4. Upper Key residents were more likely to indicate that they would evacuate to Dade County than did Lower Key residents. The latter group were more likely to evacuate locally (40%) than were residents of the Upper Keys (12%). The responses of residents of the Middle Keys were in between those of Upper and Lower Key residents on both percentages.

5. There was great similarity between the results of the present study and the 1983 behavioral study.

LOWER SOUTHEAST FLORIDA HURRICANE EVACUATION STUDY

Introduction

Four major sections comprise this report. These sections are: (1) a review of studies of actual hurricane evacuation, (2) a review of behavioral studies of reactions to hypothetical hurricanes, (3) a review of the literature regarding the responses of immigrant groups to evacuations as well as a summary of the results of interviews with persons knowledgeable about various immigrant groups in Southeast Florida regarding issues of importance to emergency managers, and finally (4) a behavioral study of residents of Monroe County.

Review of Actual Hurricane Experience

A potentially useful source of information in predicting hurricane evacuation behavior in Southeast Florida is the behavior of people in actual hurricane threats in other locations. However, before results from actual hurricane behavior can be generalized to other locations and even to other storms in the same location, a number of issues must be addressed. These issues include methodological concerns and analysis techniques. The following is a critique of the various studies which have been conducted of actual hurricane evacuation behavior.

Before discussing the actual studies, it should be pointed out that much of the literature on hurricane evacuation behavior is not published in scholarly books or journals; rather it

appears in technical reports which are difficult to obtain. We have attempted to obtain all primary documents. However, in some cases, this was impossible; therefore secondary sources were used. Listed in Table 1 are the studies included in this review and whether a primary or secondary source was examined.

Methodological Concerns

In reviewing the various studies of actual hurricane behavior, a number of methodological problems surfaced which question the validity and/or generalizability of these studies. These issues include: 1) vulnerability of respondents, 2) types of communities studied, 3) demographic characteristics of the populations, 4) sample size, 5) type of housing, and 6) time between the evacuation and the survey.

For the emergency manager to plan for an evacuation, it is important to know how many people will evacuate if an evacuation order is given. It is necessary to consider both the percentage of the population ordered to evacuate who will actually do so and the percentage of the population not under an evacuation order who will also evacuate. This latter type of evacuation has been termed "shadow evacuation" (Sorenson, Vogt & Mileti, 1987). Shadow evacuation increases both the number of people in public shelters and the number of vehicles on the roads. The problem of shadow evacuation has only been directly addressed in the work of Nelson, Kurtz, Gulitz, Hacker, Lee and Craiger, (1988). Some other studies do touch on the issue by examining the percentage of evacuees beyond a certain area near the coast. However, how

Table 1

Studies of Actual Hurricane Behavior

Warning and Evacuation in Hurricanes Elena and Kate: Pinellas and Bay Counties, Florida. E. J. Baker, 1987.

Household Response to Warnings. T. M. Carter, 1983.

Models of Hurricane Evacuation Behavior: Final Report. M. Coovert and C. E. Nelson, in press.

Eastern North Carolina Hurricane Evacuation Study. U. S. Army Corps of Engineers, 1987.

Behavioral Analysis Tri-State Evacuation Study. Hazards Management Group, 1986.

Hurricane Evacuation Behavior in the Middle Atlantic and Northeast States. Hazards Management Group, 1989.

*Community Response to Natural Hazard Warnings: Final Report. R. K. Leik, T. M. Carter, and J. P. Clark, 1981.

Before the Wind: A Study of Response to Hurricane Carla. H. E. Moore, F. L. Bates, M. V. Layman, and V. J. Parenton, 1963.

Table 1 (Continued)

Post-Hurricane Survey of Evacuees Sheltered in the Tampa Bay

Region During Hurricane Elena in 1985. C. E. Nelson, A.

Kurtz, E. Gulitz, G. Hacker, M. Lee, and P. Craiger, 1988.

Models of Hurricane Evacuation Behavior: Interim Report. C. E.

Nelson, A. Kurtz, A. Powell, G. Hacker, B. Fritzsche, and M.

Coover, 1989.

Citizens Response to Warnings of Hurricane Camille, Report No.

35. K. Wilkenson and P. Ross, 1970.

Reaction to Storm Threat During Hurricane Eloise, Report No. 51.

G. E. Windham, E. Posey, P. Ross, and B. Spencer, 1977.

*Results quoted from secondary source.

vulnerable the people were is unclear.

Studies typically have shown a positive relationship between vulnerability of residence and evacuation rate (e.g. Moore et al. 1963; Wilkinson & Ross, 1970; Baker 1987; Nelson et al. 1988). Therefore, in order to compare evacuation rates between studies and to understand the evacuation behavior in any study, it is necessary to know the degree of vulnerability of the respondents. However, in many studies the degree of vulnerability is not specified (e.g. Eastern North Carolina, 1987; Moore et al. 1963) or is somewhat unclear because distance from the water rather than elevation of residence is used (e.g. Baker, 1987; Hazards Management Group, 1989). With the development of the SLOSH model, hurricane evacuation zones which correspond to actual vulnerability can be specified and used as the sampling frame. This methodology also controls for the fact that the same type of hurricane can lead to vastly different heights of the storm surge depending on location. Because all residents on barrier islands need to evacuate, the problem of vulnerability is less important when examining the behavior of these residents.

As Sorenson et al.(1987) indicated, there are few studies which address a major evacuation of a metropolitan area except for Leik, Carter and Clark's study (1981) of the response to Hurricane David in Miami. Since the publication of the Sorenson report, both Baker (1987) and Nelson, et al. (1988) examined evacuation behavior during Hurricane Elena in Pinellas County and the Tampa Bay Region, respectively. Considering the few studies

of urban areas, it is virtually impossible to generalize the findings from rural or semi-rural areas to metropolitan areas. There can be serious questions raised such as comparability of evacuation rates, relative influence of the broadcast media, and place of refuge in terms of both location and type (e.g. friend or relative, public shelter, etc.). In addition, access to city streets may make evacuation easier for mainland urban residents compared to their rural counterparts. On the other hand, those who live on barrier islands in urban areas may have more difficulty in evacuating than mainland residents because of the volume of automobiles relative to the number of bridges.

Another difficulty in generalizing hurricane evacuation behavior from one area to another is the vast difference in the demographic characteristics of the populations. The age composition and proportion of recent immigrants varies widely among communities. Studies of the Elena evacuation which included a large number of elderly evacuees found a higher percentage of evacuees went to public shelters than has been typically found in other studies (Baker, 1987; Nelson et al. 1988). Moreover, Nelson, Kurtz, Powell, Hacker, Fritzsche and Coovert (1989) found that public shelter evacuees were older than evacuees who went to other types of refuge. As will be discussed later, we know virtually nothing about the evacuation behavior of ethnic groups.

In some studies, the sample size used has been too small to draw any firm conclusions. For example, the Hazards Management Group's (1988) study of evacuation during Hurricane Gloria had

samples in most cases of only 100. With the relatively low evacuation rate, typically around 50 percent, the findings involved only 50 evacuees and 50 nonevacuees. Such sample sizes are too small to conduct meaningful multivariate analyses, and they reduce the probability of finding significant univariate differences. In addition, it becomes almost meaningless to conduct analyses on various subgroups within the population (e.g. mobile home residents, elderly, etc.).

Another problem with much of the research is a failure to either specify or analyze the results by housing type. Mobile home residents are required to evacuate in any category hurricane, yet no study except Nelson et al. (1988) has examined the behavior of mobile home residents specifically. Part of the problem is that in most studies too few mobile home residents are sampled because either the sample size is too small or only areas threatened by the storm surge are included. Mobile homes tend to be located in areas not directly affected by the storm surge.

The wording of some questions hinders comparison of results between studies. For example, in asking respondents place of refuge, out of town is used as a response (e.g. Hazards Management Group, 1986; 1989). This description of destination causes problems because we really do not know how far people traveled. In locations where there are many towns in a small area (e.g. Pinellas County), going out of town could mean traveling no more than two or three miles. Another example of ambiguous wording concerns asking people when they were notified to evacuate. The question really concerns when people believed

they should evacuate. For example, many people hear on television that an evacuation order has been issued but are not sure if it applies to them.

A final methodological issue concerns the time between the event and the survey. This time interval has varied from a few weeks (Wilkinson & Ross, 1970) to two years (Nelson et al. 1988; Hazards Management Group, 1989). For questions such as place of refuge, this is not a real problem as people tend to remember important events. However, questions regarding how long it took to leave after notification are no doubt less accurate as time passes because of forgetting.

Two conclusions can be derived from the problems enumerated above. First, generalizing the results of these studies to other populations and areas must be done with extreme caution. Second, more large-scale, carefully designed research must be undertaken following a major evacuation caused by a hurricane.

Analytical Concerns

A major problem in the hurricane evacuation literature is the almost total lack of sophisticated analysis of the data. The typical study only presents frequencies (e.g. percent evacuating, percent going to friends or relatives, etc.) and some cross-tabulations (e.g. percentage of people over 65 who evacuated compared to the percentage under 65 who evacuated).

Since evacuation behavior is a complex behavior, there may be many variables which affect whether a person evacuates or not. For example, the Hazards Management Group (1989) proposed a

model in which seven variables are hypothesized to influence evacuation: 1) risk area 2) actions by officials 3) threat factors 4) evacuation costs 5) behavior of neighbors 6) appeals/offers from others and 7) prior beliefs about safety of residence. Unfortunately, they provide no test of their model. Therefore, it's validity cannot be ascertained. In attempting to predict future evacuation behavior multivariate analyses such as multiple regression or structural equation modeling is needed. These techniques were used by Carter, Kendall and Clark (1983) in a Hurricane Frederick and Coover and Nelson (in press) in Hurricane Elena.

Carter et al. (1983) developed a two stage model of family structure on the manner in which residents responded to the hurricane warnings. The model they proposed examined variables which predicted whether people considered evacuation or not. Official statements (watch, warning, evacuation recommendation), unofficial information (advice on how to prepare for hurricanes), risk perception (prior flooding and flooding likelihood), and social contacts (discussions of previous hurricanes, whether friends or relative checked on their safety) were all variables which were predictors of evacuation consideration as shown in a multiple regression analysis. The second stage of the model was designed to predict actual evacuation. It was found, in addition to considering evacuation, additional information (where to go and evacuation routes) and confirmation (direct notification by authorities and discussion of evacuation plans with relatives or neighbors) were significant predictors of actual evacuation.

Family structure influenced the decision making process in that "single residents who live alone rely much less on the information they receive and much more on their social contacts as a basis on which to consider evacuation. In contrast, married couples with children appear to form more independent decision-making groups in that they rely more heavily on the information they receive and less heavily on their social contacts" (p. 103). Once having considered evacuation, single residents tend to evacuate with little effect from other information while married couples with children rely more on perception of storm surge and confirmation from other sources. Thus, family structure did influence the decision making process by which people decided to evacuate or not.

Coovert and Nelson (in press) used structural equation modeling to construct a model of whether people evacuated or not during Hurricane Elena. The results show that predicting evacuation behavior is a complex process, and that variables can have both direct and indirect relationships to evacuation. An indirect relationship is one in which one variable affects another variable and the latter variable affects evacuation. For example, hurricanes zone affected evacuation directly in that people in more vulnerable zones were more likely to evacuate than people who lived in less vulnerable areas. Hurricane zone affected evacuation indirectly through type of home. People in mobile homes tend to live in less vulnerable zones but are more likely to evacuate than residents of other types of structures.

The overall model of evacuation behavior contained five

exogenous variables (i.e. variables not influenced by other variables in the model) and five endogenous variables (i.e. variables which are influenced by other variables). The five exogenous variables were: (1) evacuation zone, (2) health problems, (3) income of respondents, (4) age of respondents, and (5) other hurricane experience. The endogenous variables were (1) use of the hurricane tabloid, (2) knowledge of the tabloid, (3) pets, (4) type of home, and (5) evacuation behavior.

Not only was a model of overall evacuation developed, but models were also developed for each of five evacuation zones ranging from barrier islands to areas well outside the evacuation area. This type of analysis is extremely important because variables which predict evacuation behavior in one zone may not predict it in another zone. For example, on the barrier islands, older people were more likely to evacuate than younger people while in the most vulnerable mainland area, the reverse was true. Previous research has not examined risk area in conjunction with other variables. Thus, we have no idea of the relationship of these other variables (e.g. age, income, etc.) to risk area and more importantly how these variables are related to evacuation when the effect of risk is taken into account.

Research Especially Relevant to Southeast Florida

Rather than examining in detail all the research cited in Table 1, the focus of this review will be on studies of urban areas. Other studies will be used to examine whether the findings generalize to other areas. The following topics will be

considered: (1) evacuation rate, (2) type of refuge, (3) local versus long distance travel, and (4) time to evacuate.

The studies most likely to generalize to Southeast Florida are those that involved a recent hurricane which caused an evacuation of an urban area in Florida (Baker, 1987; Nelson et al., 1988; 1989). The response to Hurricane David (Leik et al., 1981) was unusual because only 38% of the respondents evacuated compared to the average of 70 percent reported by Baker (1987) and Nelson et al. (1989). It should be noted that we were unable to obtain an original copy of the Leik study.

Evacuation Rates

Baker (1987) used four risk-area classifications based upon the city in which the respondent lived in Pinellas County. These were labeled high, mixed, low to moderate, and low risk. The high risk areas consisted principally of beach communities. A problem with this classification scheme was that for the mixed areas there was wide variation in vulnerability. Other studies used the SLOSH area as the sampling frame (Nelson et al., 1988; 1989). Thus, the following five-area classification scheme was developed: 1) barrier islands, 2) evacuation Zone A mainland, 3) evacuation Zone B, 4) evacuation zone C, and 5) outside evacuation zone C. The sample included residents of Hillsborough, Manatee and Pasco Counties, as well as Pinellas County.

The evacuation rates reported by the two studies for barrier islands in Pinellas County were virtually the same: Baker (1987) 93% and Nelson et al. (1989) 87%. For their total sample, Nelson et al. (1989) found that 88% of the barrier island

residents evacuated compared to 70% who lived in Zone A on the mainland and 58% of Zone B respondents. The above mentioned groups were those under mandatory evacuation. Thirty percent of Zone C respondents and 19% of residents outside of Zone C also evacuated. These percentages are inflated as to the actual number of evacuees who should not have evacuated because mobile home residents who were required to evacuate were included in the sample. When mobile home residents were excluded, the evacuation rate in Zone C was 22% and outside Zone C 10%.

How do these results compare to evacuation rates in other studies? Shown in Table 2 are the evacuation rates reported in other studies by risk area when available. These data clearly point to one major conclusion---the more vulnerable the area, the higher the evacuation rate. Barrier island residents always had a higher evacuation rate than mainland residents in the same geographical location. Likewise, coastal mainland residents were more likely to evacuate than inland residents.

The data also indicated a problem area; namely, the relatively lower evacuation rates in vulnerable coastal mainland areas. Certainly, emergency managers must emphasize evacuating barrier island residents in any evacuation because of both their vulnerability and the lack of access routes to safety on the mainland. However, more emphasis should be placed on evacuating low-lying mainland residents.

Another issue raised by the results of these studies concerns the great differences in actual evacuation rates between various localities. Citizens tend to look toward officials for

Table 2

Percentage of Respondents Evacuating

Baker (1987a)

Elena Pinellas County, Florida

On Water	95%
Within One Block of Water	86%
More Than One Block of Water	41%

Baker (1987b)

Elena I Bay County, Florida

Beach	73%
Panama City	42%

Elena II

Beach	78%
Panama City	31%

Kate

Beach	78%
Panama City	28%

Hazards Management Group (1989)
East Coast 19 Communities

Gloria

Delaware Beaches	76%
Delaware Mainland	56%
Ocean City	63%
Warwick, Rhode Island	61%
Maryland Eastern Shore	48%
South New Jersey	58%
North New Jersey	43%
Groton, Connecticut	43%
Fairfield	38%
Newport	37%
Wareham	36%
Ann Arundel	32%
Suffolk	29%
Newport News	28%
Rockaway	25%
Norfolk	25%
Virginia Beach	17%
Denton	8%

Table 2 (Continued)

Moore et al. (1963)

Carla - Louisiana and Texas

Baytown	39%
Calhoun County	89%
Cameron Parish	97%
Chambers County	66%
Galveston	67%

Wilkinson & Ross (1970)

Camille - Harrison County, Mississippi

Elevations

10 Feet or Less	92%
11-15 Feet	91%
16-20 Feet	72%
21-25 Feet	46%
Over 25 Feet	22%

Marchese & Busha (1983)

David - Treasure Coast, Florida

Indian River County

Barrier Islands (Zone 1)	79%
Mainland Coastal (Zone 2)	27%
Inland (Zone 3)	17%

Martin County

Barrier Island (Zone 1)	64%
Mainland Coastal (Zone 2)	29%
Inland (Zone 3)	17%

St. Lucie County

Barrier Islands (Zone 1)	70%
Mainland Coastal (Zone 2)	18%
Inland (Zone 3)	27%

Table 2 (Continued)

East Carolina Behavioral Analysis (1987)

Diana

North Carolina Southern Mainland	40%
North Carolina Southern Beach	79%
South Carolina Myrtle Beach	48%
South Carolina Georgetown	9%

Tri-State Study (1986)

Alabama, Mississippi, Florida

Eloise (1975)

Beach	89%
Bays	55%
Inland	50%

Tri-State Study (1986)

Alabama, Mississippi, Florida

David (1979)

Island	75%
Mainland	24%

Nelson et al. (1989)

Tampa Bay Region, Florida

Elena

Barrier Island	87.8%
Zone A Mainland	70.0%
Zone B	58.5%
Zone C	29.6%
Outside Zone C	18.7%

guidance in emergency situations. Therefore, evacuation rates appear to be higher in areas where an evacuation is ordered instead of only recommended or not recommended at all.

The study of Elena by Nelson et al. (1988) supported this conclusion in that the two most important sources of information regarding evacuation were law enforcement personnel and television. In counties with higher evacuation rates, residents were more likely to indicate that they evacuated because of notification by law enforcement personnel. In counties with lower evacuation rates, television was more frequently indicated as the source of information.

People seldom evacuate without notification. For example, only 8 percent of the people who did not hear the evacuation order in Hurricane David in Miami evacuated, while 80 percent of the people who did hear the order evacuated (Leik, et al. 1981). Similarly, in Hurricane Elena, only 9 percent of the evacuees who should have evacuated did so based on their own decision compared to 14 percent in border areas (Zone C) and 34 percent outside Zone C.

As for other predictors (e.g. age, socio-economic status) of evacuation behavior, the results presented in the various studies do not allow generalization because, as was pointed out earlier, the data analyses were not sophisticated enough to test the various relationships. For example, if two predictors of evacuation behavior correlate, their effect on each other must be controlled for statistically before any conclusions can be drawn.

Type of Refuge

An important concern of emergency managers is the place of refuge of evacuees, especially public shelters (see Table 3). These figures show a wide variation in the use of public shelters. In some cases, as in Cameron Parish, Louisiana, the terrain is such that nearby use of shelters is not feasible (Wilkinson & Ross, 1970). This is also a problem in a major hurricane in some counties in North Carolina and Monroe County, Florida. As a broad generalization, about 20-25 percent of the evacuees stayed in public shelters. The Tampa Bay Elena survey (Nelson et al. 1988) showed relatively little variability across the four-county region in public shelter usage; the range per county was from 16 to 29 percent. However, the extreme variability in this type of data can not be overemphasized. For example, 31 percent of evacuees in Hurricane Camille went to public shelters (Wilkinson & Ross, 1970).

Although a number of variables (e.g. socio-economic status) have been hypothesized to influence shelter usage, two recent studies have failed to find any correlates of shelter use. Hazards Management Group's (1989) study of the evacuation behavior during Hurricane Gloria throughout the Middle Atlantic and North Eastern states found no variables which correlate with public shelter use. Furthermore, Coover and Nelson (1989) reported that for Hurricane Elena, no satisfactory models could be developed which could predict public shelter usage.

Local versus Long Distance Travel

Another issue facing emergency managers and traffic

Table 3

Percentage of Evacuees Going to Public Shelters

Hurricane

Elena (Nelson et al., 1989)
Tampa Bay Region, Florida

Barrier Island	17%
Zone A Mainland	28%
Zone B	27%
Zone C	22%
Outside Zone C	31%

Elena (Baker, 1987)

Pinellas County, Florida	17%
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Elena I Bay County, Florida

Beach	10%
City	16%

Elena II Bay County, Florida

Beach	8%
City	18%

Beach	8%
City	25%

David - Florida

Indian River County	23%
Martin County	16%
St. Lucie County	14%

Camille - Mississippi

Harrison County	31%
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Carla - Louisiana and Texas

Cameron Parish	6%
Chambers County	40%
Galveston	30%
Baytown	26%
Calhoun County	18%

Table 3 (Continued)

Frederick (Local Public Shelters)

Alabama, Mississippi, Florida

Grand Isle	2%
Pass Christian	13%
Mobile	8%
Pensacola	2%
Panama City	6%

Diana - South and North Carolina

North Carolina Beach	9%
North Carolina Mainland	25%
Myrtle Beach	24%
Georgetown	20%

Gloria - East Coast

Wareham	22%
Warwick	8%
Newport	5%
Fairfield	11%
Groton	23%
Suffolk	25%
Rockaway	5%
Northern New Jersey	14%
Southern New Jersey	10%
Delaware Beaches	13%
Delaware Mainland	32%
Anne Arundel	49%
Crisfield	32%
Ocean City	14%
Newport News	45%
East Shore	31%
Virginia Beach	22%
Norfolk	7%

engineers is the number of people evacuating to out of town locations. Typically, there are relatively few highways out of the threatened area so a large flow of vehicles using these routes could lead to major traffic problems. In addition, the evacuation would have to be coordinated with other jurisdictions. As discussed earlier, there is a major problem in the definition of what constitutes "out of town." In areas where there are many towns, going out of town may mean traveling only two or three miles. However, the definitions used in the studies are unclear as to the distance traveled.

In Hurricane Elena, relatively few people left their own county to seek shelter, and most of those that did, did not leave the four-county region (Nelson et al., 1988). They found that out of county evacuation ranged from 10 percent in Hillsborough County to 28 percent in Manatee County with the other counties in the 20-23 percent range (see Table 3). In response to Hurricane Gloria, Hazards Management Group (1989) reported that in half of their locations more than 50 percent of the evacuees went out of town, but in 15 of the 18 sites more than half reached their destination in 30 minutes or less. For example, in Southern New Jersey, 88 percent reported going out of town, but 57 percent reached their destination within 30 minutes. There was some indication in their data that the people from beach areas were more likely to travel over 30 minutes to reach their destination.

In Hurricane Carla, 81 percent of Cameron Parish, Louisiana, evacuees and 50 percent of Chambers County, Texas evacuees

traveled 25 or more miles to obtain shelter. As previously noted, Cameron Parish is extremely low lying. Hence, they had to travel far to reach a safe elevation (Moore et al. 1963). In addition, 38 percent of the Galveston evacuees, 47 percent of the Bagtown, and 96 percent of the Calhoun County evacuees traveled more than 25 miles.

Hazard Management Group (1986) reported that in response to Frederick, the out of town evacuation ranged from 60 percent in Pass Christian, Mississippi, to 80 percent in Panama City Beach. However, we do not know how far they traveled. During Camille, only 20 percent of the evacuees left the area (Wilkinson & Ross, 1970). It is not surprising that beach residents take a longer time to reach their final destinations than do their mainland counterparts since they have to travel farther to reach a safe location. Considering the topography of most of Southeast Florida, except south Dade County and the Keys, evacuees would not have to travel far to reach safe areas. Moreover, unlike the Panhandle of Florida where people can evacuate inland, in Southeast Florida, there are relatively few inland cities outside the area. Therefore, one could expect relatively little evacuation outside the area.

Time to Evacuate

The final topic to be considered is response time (i.e. how long it takes people to leave once they have been notified of an evacuation). A methodological problem with this data is that people may forget the exact time they left, especially if the surveys were conducted well after the event. Another problem

with response time data is that there are two time periods. First, there is the time between the issuance of an evacuation order and when a person actually hears it. Second, there is the period between hearing an evacuation order and leaving home. Typically, the only data that is reported in evacuation studies is the actual time people left. Therefore, the two time periods cannot be separated.

The response to Hurricane Elena was quick. According to Nelson et al. (1988), one half the evacuees left within 30 minutes of notification and three-fourths had left within one hour. There was a difference between when people were notified to leave as a function of county of residence. Hillsborough and Manatee County evacuees reported being notified later than those in Pinellas and Pasco Counties. It should be noted that Hurricane Elena was unusual in that evacuation was unexpected and in the middle of the night. Still, the response indicates that if necessary, people will leave quickly.

The study of the response to Hurricane Gloria (Hazards Management Group, 1989) reported only a comparison of beach and mainland Delaware response times. In this study only the time of day was presented, so we do not know when the evacuation was ordered or when people were notified. As in the case of the Nelson et al. (1988) study, data were collected two years after the event.

Presented in the Tri-State Behavioral Study (Hazards Management Group, 1986) are a variety of cumulative evacuation curves including the response to Eloise in Panama City, Frederick

in five areas of the Gulf Coast, and David in Miami. An examination of these curves shows a steep increase in the rate of evacuation following a strong advisory notice. For example, in Hurricane Eloise, even though the order was given at midnight, by 3:00 a.m., 70 percent of the people had evacuated. In Pensacola, during Frederick, 70 percent of the people had evacuated within two hours of the advisory. The only exceptions to this generalization were Miami during its near hit by Hurricane David and Galveston during Alicia. In Miami, 25 percent of the people evacuated before the warning but only 15 percent more evacuated during the next three hours. In Galveston, 20 percent had evacuated by the time a warning was issued but six hours later only an additional 5 percent evacuated. Because these data do not indicate when people heard the order, we do not know whether the lack of response was due to not hearing the notice or slowness of response.

Studies of actual hurricane evacuation behavior has the potential of being the best source of data for future evacuation planning. However, large scale studies which are methodologically sound and use sophisticated data analysis techniques must be undertaken after every evacuation. When a sufficient number of studies have been conducted, various methods of comparing results across studies (e.g. model testing, meta-analysis) should be used.

REVIEW OF BEHAVIORAL STUDIES

Predicting human behavior in any situation is an extremely difficult task which becomes even more difficult in times of emergency. Nevertheless, in order to develop hurricane evacuation plans, emergency management officials need to attempt to predict the response of residents in their area to a hurricane threat. Because actual evacuation data is not available for most locations, behavioral studies have been used to predict the response of the population to a hurricane evacuation order. Basically, all of these studies (see Table 4) ask a random sample of respondents what they would do if ordered to evacuate. Six basic questions are asked of respondents: (1) Would they evacuate or not? (2) Where would they seek refuge (friend, relative, public shelter, motel, etc.)? (3) Where is the refuge located? (4) How many people would go with them? (5) How would they get there (car, need assistance)? and (6) How long after hearing the order would they leave? These studies will be reviewed by examining methodological issues and results. In addition, results of studies of actual hurricane evacuation behavior will be compared to behavioral studies done in the same area. Finally, the utility of behavioral studies will be discussed. This review and comparison is intended to provide emergency planners with information on the amount of confidence they can put in data from behavioral studies, and it is intended to determine the extent to which future behavioral studies should be conducted.

Table 4

Behavioral Studies Reviewed

Southeast Florida (1983)

Treasure Coast (1983) (1988)

Tri-State (1986)

Eastern North Carolina (1987)

Coastal Georgia (Undated)

Tampa Bay (1980)

Central Florida (1982)

Southern Oahu (1988)

South Carolina (1986)

Withlacoochee (1984) (1989)

Apalachee (1984)

In examining previous studies, five methodological issues need to be considered: 1) differences between what people say they will do and what they actually do, 2) the sampling strategy used in the studies, 3) the effect of population mobility and growth on the predictions, 4) the effect of time and history on predictions, and 5) the issue of "shadow evacuation."

The validity of responses to a behavioral survey is extremely important. Do people actually do what they say they are going to do? It is important to realize that behavioral studies can only give us "ball park" figures. Many variables may affect the actual behavior of people in a hurricane evacuation situation and, as discussed earlier, these have not been well documented.

The various behavioral studies have used a variety of techniques to specify the population under study. For example, the 1980 Tampa Bay Study used census tracts that were adjacent to bodies of water, but the tracts were not related to probable surge. Thus, many people who would not have to evacuate even in a Category V storm were included. Some studies have stratified by mainland or beaches (Eastern North Carolina, 1987), or high-low risk area (Tri-state, 1986). Although the Coastal Georgia Study (undated) stratified their sample into three hurricane zones, voter registration lists were used rather than telephone books to generate the sample. This method would probably bias the results since newer and poorer residents probably are less likely to be registered voters. The South Carolina Study (1986) fails to state either the risk area or how the sample was

selected. The Treasure Coast Study (Marchese & Busha, 1983) stratified their sample by county and risk area and they selected their sample using a city directory. Basically, it is difficult, if not impossible, to compare the results of studies in which the sampling frame and methods of sample selection are so different. As mentioned earlier, the rate of evacuation increases as vulnerability increases. Thus, behavioral studies should either stratify their samples in terms of vulnerability or compare ex post facto the responses in terms of vulnerability.

In attempting to predict hurricane evacuation behavior, researchers are not examining a static situation but rather a dynamic one because people move frequently and there is often much growth in vulnerable areas. The Miami area can be used to exemplify both points. As Miami Beach becomes gentrified, elderly and poor residents are being replaced by younger, more affluent residents. Thus, the results of a study 10 years ago may not be valid because of the demographic changes that have taken place. Recently, high-rise apartments have been constructed on the west shore of Biscayne Bay. How will these people respond if a hurricane strikes? Will their response be the same as the rest of the population?

Another problem in prediction is time and history. In other words, what events have taken place between the time of the behavioral survey and the actual hurricane? These events can be person-made or natural. For example, Hurricane Floyd, a minimal storm, went up the Florida Keys in 1987. How did this event effect what people in the Keys would do now if a hurricane

approaches? Will those who evacuated at that time still evacuate, or will they suffer from the "cry wolf" syndrome ("There was no damage then, so why should I evacuate again?")? Likewise, will people who did not evacuate believe that they have now experienced the full impact of a hurricane? In addition, what is the impact of media coverage of other hurricanes or public awareness campaigns?

Finally, there are two groups of people that are seldom, if ever, studied: mobile home residents and individuals who live outside of evacuation zones who also evacuate. The former group should evacuate in any storm while the latter group adds to the strain on both highways and public shelters. The behavior of both these groups needs to be considered in evacuation planning.

Review of Results

Four variables from a variety of behavioral studies that can be compared are: 1) percentage of respondents who state they would not evacuate if ordered to do so, 2) type of refuge indicated by potential evacuees, 3) place of refuge of potential evacuees, and 4) evacuation response times of potential evacuees. It must be emphasized that this is a comparison of what people say they would do, not what they actually do.

In general, practically all people say that they will evacuate if ordered to do so. Unfortunately, there are extremely important exceptions. For example, only three-quarters of the respondents in the Lower Southeast Florida Study (Post, Buckley, Schuh & Jernigan, Inc., 1983) indicated that they would evacuate.

Even more alarming is the fact that 31 percent of the residents of the Lower Keys indicated that they would not evacuate if ordered to do so (see Table 5). As shown in the current study of Monroe County, this percentage has not changed appreciably in the past six years. The only other areas in which a large proportion of the population indicated that they would not evacuate were Highlands County, Florida (an inland area) as noted by Nelson and Kleiman (1982) and in the Carolinas in a weak storm (South Carolina, 1986). Thus, it may be concluded that in the Keys and possibly in other areas of Southeast Florida, many people who should evacuate, will not. However, this assumption cannot be stated with any certainty for the other counties in Southeast Florida unless the 1983 study is replicated focusing on areas which would be ordered to evacuate.

The types of refuges the respondents indicated they would use if ordered to evacuate is shown in Table 6. For emergency managers, the most important statistic is the percentage of people planning to seek refuge in public shelters. As can be seen in Table 6, there is wide variation in the percentage of respondents who state that they will use public shelters. In the Florida Keys, only 8 percent of the potential evacuees in the Upper Keys stated they would use public shelters while 35 percent of those in the Lower Keys indicated that they would use this type of refuge. In the Tri-state (1986) and Treasure Coast (1983) studies, residents who live in less vulnerable areas are more likely to indicate that they would use public shelters. While both the South Carolina (1986) and Withlacoochee (1984)

Table 5

Percentage of Nonevacuees

Behavioral Studies

Southeast Florida

Regionwide	26.3
Monroe County	25.7
Lower Keys	30.7
Upper Keys	20.7
Dade County	25.9
Broward County	28.0
Palm Beach County	27.2

Treasure Coast

Regionwide	5.6
Zone 1	2.3
Zone 2	6.0
Zone 3	5.4

Tampa Bay

Regionwide	5.7
Hillsborough County	8.7
Manatee County	2.4
Pasco County	6.6
Pinellas County	4.7

Tri-State

Mississippi	5.0
Alabama	6.0
Florida	5.0

Central Florida

Polk County	10.9
Hardee County	24.1
Okeechobee County	9.9
Highlands County	18.6
DeSoto County	15.6

Table 5 (Continued)

Withlachoochee

Coastal	10.6
Inland	1.8

Coastal Georgia

Island	5.0
Zone 1 (high-risk households)	22.0
Zone 2 (moderate-risk households)	15.0
Zone 3 (low-risk area)	13.0

Carolinas

Weak Storm

North Carolina Mainland	38.0
North Carolina Beach	64.0
Myrtle Beach	35.0
Georgetown	33.0

Strong Storm

North Carolina Mainland	8.0
North Carolina Beach	14.0
Myrtle Beach	3.0
Georgetown	4.0

Table 6

Type of Refuge

Behavioral Studies

<u>Study</u>	<u>Friend/Relative</u>	<u>Motel/Hotel</u>	<u>Public Shelter</u>	<u>Don't Know</u>
Southeast Florida				
Regionwide	39.2	13.9	31.6	15.3
Monroe County	46.7	21.8	20.6	10.8
Lower Keys	38.7	17.4	35.4	8.5
Upper Keys	53.4	25.5	8.1	13.0
Dade County	36.7	10.5	38.4	14.7
Broward County	41.0	9.2	31.8	17.9
Palm Bch. County	32.2	21.8	27.4	18.8
Treasure Coast				
Regionwide	28.7	10.7	50.2	10.4
Zone 1	36.0	20.0	33.6	10.4
Zone 2	28.3	9.1	52.6	10.1
Zone 3	26.9	13.3	47.3	12.5
Tampa Bay				
Regionwide	25.8	18.8	37.9	17.4
Hillsborough Cty.	29.5	15.3	38.6	16.5
Manatee County	28.5	20.3	34.0	17.3
Pasco County	14.5	19.0	49.5	17.5
Pinellas County	28.3	20.1	33.8	17.8
Tri-State				
Mississippi				
High-risk	43.0	12.0	17.0	22.0
Low-risk	33.0	12.0	40.0	10.0
Alabama	42.0	34.0	6.0	13.0
Florida				
High-risk	40.0	37.0	7.0	10.0
Low-risk	22.0	17.0	42.0	12.0
Central Florida				
Polk County	21.7	12.3	49.4	16.6
Hardee County	31.7	8.9	51.2	8.1
Okeechobee	31.9	19.4	39.6	9.0
Highlands	18.1	13.4	54.4	14.1
DeSoto County	21.1	9.8	58.5	10.6

Table 6 (Continued)

<u>Study</u>	<u>Friend/Relative</u>	<u>Motel/Hotel</u>	<u>Public Shelter</u>	<u>Don't Know</u>
Withlacoochee				
Coastal	34.0	24.1	25.6	16.3
Inland	13.7	20.6	40.0	25.7
Coastal Georgia				
High-risk	19.8	22.1	44.2	9.3
Moderate-risk	29.4	10.6	49.4	2.4
Low-risk	39.1	14.9	25.3	16.1
Carolinas				
North Carolina				
Mainland	25.0	8.0	48.0	9.0
Beach	45.0	14.0	18.0	3.0
Myrtle Beach	30.0	20.0	35.0	11.0
Georgetown	28.0	6.0	57.0	8.0

NOTE: Figures represent percentages.

studies support this finding, the Coastal Georgia (undated) study does not. As a very broad generalization of the Florida studies, anywhere from one-quarter to one-half of the respondents indicated they would use public shelters.

Another issue emergency managers must consider is how many evacuees plan to leave the area (see Table 7). As to be expected, the vast majority of the evacuees from the Florida Keys plan to leave Monroe County, while less than one-half of the rest of Southeast Florida respondents indicated that they would evacuate beyond their home county. In the Treasure Coast region, only one-fourth of the evacuees stated that they would travel a "long distance". The data from Coastal Georgia regarding distance traveled are more similiar to the findings in the Keys than to other areas studied. The important factor in explaining these findings may be the degree of safety in one's home county. If safe havens are close by, people will probably not want to travel long distances (e.g. over 50 miles).

The final variable studied in most behavioral studies is evacuation response (see Table 8). As can be seen, the various studies have asked this question and reported the data in a wide variety of ways. Thus, the data can not be compared between studies. The only generalization that can be made is that people will leave when ordered to do so. In certain areas (e.g. Upper Keys), a substantial number of people may leave before an actual order is given. However, the definition of "leaving before an order" is unclear (Southeast Florida, 1983). Does it mean when a hurricane watch has been given or a voluntary evacuation advisory

Table 7

Evacuees Who Plan To Leave Area
Behavioral Studies

Southeast Florida (out of county)

Monroe County	83.4
Lower Keys	73.9
Upper Keys	89.2
Dade County	36.6
Broward County	43.3
Palm Beach County	46.7

Treasure Coast, Florida

Region wide	24.2
Indian River	21.4
Martin	23.9
St. Lucie	26.7

Central Florida

Polk County	23.0
Hardee County	30.5
Okeechobee	31.9
Highlands	18.3
DeSoto County	12.2

Coastal Georgia

Islands	67.0
Zone 1	67.0
Zone 2	73.0
Zone 3	75.0

NOTE: Figures represent percentages.

Table 8
Evacuation Times
Behavioral Studies

<u>Southeast Florida</u>	<u>Before Order</u>	<u>Immediately After</u>	<u>Hours Later</u>
Regionwide	27.9	65.9	6.1
Monroe County	39.0	49.1	11.8
Lower Keys	30.3	59.2	10.5
Upper Keys	46.7	40.3	13.0
Dade County	25.0	69.0	6.1
Broward County	21.8	74.9	3.2
Palm Beach	32.0	64.6	3.4
<u>Treasure Coast</u>	<u>Immediately After</u>	<u>1 - 2 Hours</u>	<u>3 Hours or More</u>
Regionwide	77.2	19.8	3.0
Zone 1	80.3	14.9	4.7
Zone 2	78.6	18.9	2.4
Zone 3	69.8	25.6	4.6
<u>Tampa Bay</u>	<u>Immediately After</u>	<u>Certain Hours</u>	
Regionwide	81.7	18.2	
Hillsborough Cty.	80.2	19.8	
Manatee County	75.0	25.0	
Pasco County	81.0	19.0	
Pinellas County	83.8	16.2	
<u>Tri-State</u>	<u>Evacuate Before Order</u>		
Mississippi			
High-risk	77.0		
Low-risk	62.0		
Alabama	72.0		
Florida			
High-risk	70.0		
Low-risk	29.0		

Table 8 (Continued)

<u>Central Florida</u>	<u>Before Order</u>	<u>When Ordered</u>	<u>Within 1 hr</u>		
Polk County	16.1	68.9	94.1		
Hardee County	13.9	59.9	92.6		
Okeechobee	27.0	61.2	94.6		
Highlands	13.9	62.2	95.3		
DeSoto County	17.0	66.7	94.4		
<u>Withlachooshee</u>	<u>Immediately After</u>	<u>Certain Hours</u>			
Coastal	82.8	17.2			
Inland	87.2	12.8			
<u>Coastal Georgia</u>	<u>< 1 hr</u>	<u>1-3 hrs</u>	<u>3-6 hrs</u>	<u>>6 hrs</u>	<u>Don't Know</u>
Islands	12.0	19.0	0.0	4.0	2.0
Zone 1	19.0	17.0	1.0	0.0	1.0
Zone 2	22.0	10.0	3.0	1.0	3.0
Zone 3	18.0	15.0	3.0	0.0	1.0

NOTE: Figures represent percentages.

has been issued? To answer these questions specific scenarios must be presented to respondents in future behavioral studies.

Comparison of Results of Behavioral Studies
to Actual Hurricane Evacuation Behavior

Behavioral surveys are used in hurricane evacuation planning to try to predict how a given population will respond in an actual hurricane. The key question is how accurate are behavioral surveys in predicting actual behavior? In only a few cases can actual hurricane evacuation behavior be compared to hypothetical responses. Nelson et al. (1988) compared the responses of individuals living in the residences surveyed in the Tampa Bay (Lochner, 1980) survey with their actual responses during Hurricane Elena five years later. Other studies (e.g. Treasure Coast, 1983; Coastal Georgia (undated)) have compared hypothetical responses to what respondents had done in a previous hurricane. In the Eastern North Carolina Study (1987), Hurricane Diana caused the evacuation of some areas during the course of the study, so hypothetical responses were compared to actual responses of another sample who were questioned about their actual behavior.

The comparison of response rates between hypothetical and actual hurricanes is impossible because in none of the cases was there a direct hit. In some areas people were ordered to evacuate and in other cases, they were not. Moreover, before people will generally evacuate, they must first realize that they are being ordered to evacuate.

Comparisons can be made between hypothetical and actual behavior in terms of type of refuge. Nelson et al. (1988) pointed out that the Tampa Bay Study (1980) underestimated the percentage of persons going to friends or relatives; the predicted figure was 31 percent and the actual was 54 percent. It also overestimated the proportion of evacuees going to both motels and public shelters. While 18 percent of the evacuees were predicted to go to motels/hotels, only 10 percent did. Also, it was predicted that 35 percent of the evacuees would go to public shelters, but only 25 percent actually did so. However, in an examination of predicted versus actual behavior by county, important similarities and differences were noted. In all counties, more people went to friends or relatives than predicted. However, the under prediction of public shelter usage was only 5 percent in Hillsborough County and 8.6 percent in Lower Pinellas County compared to 25 percent in Pasco County. Thus, for the two largest samples, the Tampa Bay Study (1980) was quite accurate in predicting shelter usage.

The Treasure Coast Study (1983) compared hypothetical responses to the actual evacuation behavior during Hurricane David. The behavioral survey overestimated actual shelter usage by 20 percent in both Zone 1 (high risk) and Zone 3 (low risk) and 35 percent in Zone 2 (moderate risk). However, there are a number of methodological problems with this comparison. First, the number of respondents was not specified. Overall, only 26 percent of the respondents who lived in the area during Hurricane David actually evacuated, although 74 percent of those in Zone 1

did so. Second, the study has a unique set of reverse circumstances. Actual behavior took place before the hypothetical questions were asked. Third, the whole sample was compared to the subsample that actually evacuated. The comparability of the subsample to the total sample cannot be ascertained because comparisons were not made on other variables. For example, there may have been a difference in age between evacuees and nonevacuees.

The Coastal Georgia Study (undated) examined what respondents had done during Hurricanes David and Dora. However, the number of evacuees was too small to draw any conclusions from their data. Both the Eastern North Carolina (1987) and South Carolina (1986) studies use the same data in examining the impact of Hurricane Diana. As mentioned previously, these were unique situations since Hurricane Diana occurred during the studies. Actual use of public shelters was less than predicted from either sample. However, it is not known how nonevacuees and evacuees differed on other dimensions. For example, were evacuees more likely to have friends or relatives living in the area?

A tentative conclusion that can be drawn from this data is that behavioral studies tend to overpredict shelter usage. By how much and when they overpredict is uncertain. However, more research is needed comparing actual versus predicted usage of public shelters in the same locations.

In general, behavioral surveys can provide useful data for planning purposes. However, emergency managers must realize the inherent difficulty in predicting future behavior based on

surveys. In addition, the methodology used in the behavioral surveys must be explicitly stated and carefully validated.

REVIEW OF IMMIGRANT POPULATIONS

Since immigrant groups comprise a large portion of the population in Southeast Florida, an attempt to predict their response to a hurricane threat is essential. To try to understand the probable behavior of the wide variety of immigrant groups, literature on the reactions of various ethnic groups to disasters is reviewed and results of interviews with key contacts within various ethnic groups are discussed in terms of a variety of issues proposed by Perry (1986) as important for emergency managers. In addition, implications of our findings for emergency management officials in Dade, Broward, and Palm Beach Counties are presented. Finally, suggestions for further research in this area are considered.

Literature Review

As Perry (1987) stated, the question of differences among racial and ethnic minorities in the experience of disasters is one of the "little studied" areas in the study of human disaster behavior. In fact, only one study was found that specifically dealt with hurricane evacuation in a minority population (Beady and Bolin, 1986). This study focused on the role of black media in dissemination of hurricane information both during and after Hurricane Frederick in Mobile, Alabama. Included in this study was a survey of 200 black families who were affected by the hurricane. Because the authors did not have a comparison group of whites, it is impossible to draw any conclusions as to

differential response patterns as a function of ethnicity. However, the results they do present when compared to the typical results found in other hurricane evacuation studies (e.g. Hazards Management Group, 1986; 1989; Nelson, et al, 1988; Windham, Posey, Ross & Spencer, 1977) certainly indicate that major differences in behavior as a function of ethnicity may well exist. In this study, although all of the respondents were warned about the hurricane, only 31.5% evacuated their homes. In addition, of those who did evacuate 60% went to public shelters. The percentage evacuating is much smaller than that normally found in other hurricane evacuation studies. One possible reason for the low evacuation rate is that these areas were not under an evacuation order. Supporting this hypothesis is the fact that less than 17% of the respondents evacuating received evacuation orders from the police, while 83% of the evacuees relied on both television and radio for evacuation information. 69% of all the respondents received messages about evacuation from the mass media. What is unknown, however, was whether this information specifically told these individuals to evacuate. The percentage evacuating to public shelters (60%) was much higher than has been found in other studies of hurricane evacuations (20-30%).

While there was no difference between evacuees and non-evacuees in demographic characteristics, previous disaster experience was related to evacuation behavior. Those with previous disaster experience were both more likely to evacuate and to follow directions given out by the media than those without previous experience.

Much of the data comparing evacuation behavior of different ethnic groups is based on a series of studies conducted by Perry and his colleagues (see Perry, 1979; Perry & Green, 1982; Perry, Lindell & Greene, 1982; Perry, 1986). These studies examined the evacuation behavior of whites, blacks and Mexican-Americans in a flood in Abilene, Texas and a nitric acid spill in Denver, Colorado. In addition, the behavior of whites and Mexican-Americans was compared in a propane leak from a railroad car in Mount Vernon, Washington. Although none of these studies dealt with hurricanes, it is still instructive to examine the similarities and differences in response between the various groups. However, it should be kept in mind that in terms of warning, only the flood situation is analogous to a hurricane (i.e. it is a slowly developing situation). In addition, because there may be rural-urban differences in response to disasters, it should be noted that only one location was in a major metropolitan area.

Across all three studies, Mexican-Americans tended to rely upon social networks to relay warning information to a greater extent than did blacks or whites. In addition, residents of urban areas, particularly Mexican-Americans, engaged in higher levels of warning information exchange than those who lived in either semi-rural or rural areas.

The credibility of the information source has been shown to influence citizen response to evacuation warnings (Perry, 1986; Quarantelli, 1984). Warning recipients of all ethnic backgrounds and across all three studies tended to regard authorities (e.g.

police, fire fighters, uniformed emergency personnel) as highly reliable warning sources. The only exception to this generalization was the response of some blacks in Abilene, who for unspecified reasons, did not rate this source as credible. Mexican-Americans viewed the mass media as a highly reliable source across all three studies while whites and blacks tended to rate the media as less reliable than the Mexican-Americans across all three events.

After receiving a warning, there are a number of responses that people can make, some being more adaptive than others. For example, people can take protective measures, try to confirm the message, engage in family-oriented activities or do nothing. Across all three disasters, Mexican-Americans were more likely to engage in family-oriented actions (e.g. calling relatives) than were either whites or blacks. When trying to confirm the warning message, whites typically used the media as a first source of confirmation. For Mexican-Americans the media was also used most frequently as a confirmation source, but in urban areas they also frequently contacted friends or relatives for this purpose. However, blacks in rural areas contacted friends or relatives while those in urban areas more frequently contacted the media. In general, these data point to the importance of authorities and the media in informing the population regardless of ethnicity in an emergency.

Regarding evacuation destination, evacuees of all ethnic groups most frequently sought shelter in the homes of friends or relatives. However, in highly urbanized areas, blacks utilized

public shelters more frequently than did either of the other groups. In general, across all three sites, the majority of each ethnic group evacuated by family-owned car. However, in Denver, where almost all whites and Mexican-Americans used their own vehicles, one-third of the black population used some form of publicly provided transportation.

When evacuees in the Abilene flood were asked why they evacuated, past experience and official warning accounted for nearly two-thirds of the black responses and more than three-fourths of the Mexican-American responses. Although past experience was an important motivator, whites used a wider range of resources. For example, whites more frequently mentioned the evacuation of neighbors and the mass media as reasons for evacuating than did minority groups.

Respondents were also questioned as to the best ways for emergency managers to communicate hazard information. Radio was the one channel that was rated as most desirable by all ethnic groups in all three cities.

The results of these studies indicate that 1) there are differences in the way various minority groups respond to emergencies and 2) the media, especially ethnic media, are important mechanisms for disseminating emergency information. However, these conclusions are based on a limited number of studies and clearly more research is needed.

Responses of Interviewees in Southeast Florida

In order to obtain information of the various immigrant groups in Broward, Dade, and Palm Beach Counties, the emergency management directors supplied the names of 25 individuals they believed would be able to provide valid information about the respective groups (e.g. church and community leaders). These individuals were then contacted and face-to-face interviews were conducted with each of them. The following immigrant groups were discussed: East Asian, Polish and Russian Jews by one respondent each, Jamaican by two respondents, Haitian by nine respondents, and Hispanic by ten respondents. The interview guide shown in Appendix A was used in all of the interviews. The results of these interviews are discussed in terms of the following topics: 1) preparedness and 2) disaster response.

Hurricane Preparedness

As Perry (1987) indicated, a large part of disaster preparedness lies in educating citizens as to what to do in times of an emergency. This is particularly important for recent immigrants because they have not been absorbed into the American culture. It is then necessary to consider the best way to educate people taking into account the differences between various groups. In Southeast Florida the various ethnic groups can be divided into those who have had previous experience of hurricanes and those who have not. Hispanics, especially Cubans, Nicaraguans, Haitians, and Jamaicans have at least some awareness of the dangers of a hurricane while those from East Asia and especially those from Eastern Europe appear to have no idea of

the devastation a hurricane can cause.

Each of the respondents was asked specifically what they believed would be the best ways to educate their particular group regarding hurricane preparedness. Any educational campaign for the Haitian community must be aware that many of these individuals are illiterate even in their native Creole language. Programs and interviews on Haitian radio stations were mentioned by practically all the representatives of this group as the best means of educating Haitians as to disaster preparedness and procedures. Since churches play an important role in the Haitian community, much information can be communicated through church leaders, church meetings, etc. The school system also provides an opportunity to educate the Haitians. Students can be taught about hurricane preparedness and can be encouraged to transmit this information to others in their households. Furthermore, many adults attend evening classes in English and Citizenship, providing another opportunity to disseminate hurricane information. Various written media such as brochures, flyers, and articles in Haitian newspapers are also a source of communicating information. However, these materials should be more graphic because the respondents indicated many Haitians are illiterate. Finally, a few respondents suggested distributing information through the various social services (e.g. Community Centers, Health Centers, HRS offices) which serve the Haitian community.

For the Hispanic community, Spanish radio, television and newspapers were frequently mentioned as excellent methods for

reaching this group. Brochures and pamphlets in Spanish were also frequently indicated as an excellent media to reach these groups. Also, community groups, shopping centers and churches would be good locations for distributing information.

Messages on the Caribbean radio station and articles in the Caribbean newspapers were the only media mentioned by both of the Jamaican respondents as a means of educating them about hurricane procedures. Schools and churches are also a possible educational source. Since this group speaks English, language is not a barrier. Also, they are aware of the devastation Hurricane Gilbert caused in their homeland. Therefore, this group appears to be well informed of preparedness measures.

The regular media would be a good dissemination mechanism for the East Asian groups as most of this population speak English. In addition, there is a federation of East Asian groups which could serve to disseminate information through their newsletters as well as the various ethnic newspapers.

In many ways the Polish and Russian Jewish communities pose the greatest problems for education of hurricane preparedness because hurricanes do not occur in their homelands. In addition, there is virtually no media directed specifically at these groups. However, the vast majority of these individuals read English or are learning to read English and have very strong social networks. Therefore, the best strategy might be to access these networks through churches and social clubs for the Polish community and through Jewish Family Service for the Russian immigrants.

Another preparedness issue concerns whether these people live in areas that will have to be evacuated, such as areas which will be impacted by the tidal surge, flood prone areas, mobile homes or sub-standard housing. Definitive answers to these specific questions will have to await the 1990 census. However, in order to provide at least some information, each of the respondents was asked where the immigrants lived and in what type of housing.

In general, immigrant populations do not live near the coast and hence would not be affected by the tidal surge. However, there are many Haitian farm workers in south Dade County who live there year-round. Also, some of the wealthy Haitians do live in North Miami Beach. The Hispanic population is spread throughout the area with heavy concentrations in Little Havana, Hialeah, Little Managua, Allapattah, Wynwood, Lake Worth, Hallendale, West Hollywood and Miramar. The other minority groups are also spread throughout the region with no heavy concentration in any particular area.

In non-flood areas, people who live in mobile homes and those that do not feel their home is safe frequently evacuate. All of the respondents indicated that immigrants, regardless of ethnic group, do not live in mobile homes. The only exception to this is the Haitian community that lives in Belle Glade.

The areas mentioned by at least one of the respondents where a substantial proportion of Haitians live in sub-standard housing were Homestead, Florida City and Leisure City in Dade County, and throughout Palm Beach County. In Broward County the respondents

indicated that about 15-20% of the Haitian community lives in sub-standard housing. The only area mentioned in which Hispanics live in sub-standard housing was the agricultural areas of Palm Beach County and the Lake Worth area. The other immigrant communities with the possible exception of Vietnamese, Cambodians, and Bangladeshians tend not to live in sub-standard housing to any great degree. If those living in sub-standard housing believe that their homes would not withstand a hurricane, then evacuation rates among these individuals might be higher than for similar populations who live in good housing.

Disaster Response

Respondents were also questioned as to exactly how the various immigrant groups could be expected to react in a real disaster situation. These questions were concerned with the best way to notify the people to evacuate, where they would go and how they would get there. All of the respondents discussing the Haitian community mentioned Creole radio stations as a source of communication. In areas that do not have Creole radio stations, announcements should be made in Creole on both radio and television. The key point here is that the respondents indicated that Haitians trust the media, especially their own media. A number of respondents indicated that these announcements should be made by community leaders because of their high credibility. If authorities were to go through neighborhoods instructing people to evacuate, they must do so in Creole. However, there is a possible negative consequence of having authorities going into neighborhoods; namely, the illegal population would be

frightened and not follow instructions. Many Haitians are afraid of people in uniforms and suspicious of authorities.

For the Hispanic population, especially recent immigrants, the Spanish radio and television stations were always mentioned as the best way to communicate with these groups. However, one problem should be mentioned. During a recent threat in which the Miami area was ordered to evacuate, many Hispanics in Palm Beach County thought they should evacuate because the station did not clearly specify the areas under evacuation order. The two Spanish television stations are in Miami but are seen by residents in all three counties. Therefore, the media must clearly specify the threatened area. There was a difference of opinion on whether authorities should or should not go through neighborhoods. Everyone agreed the announcements must be in Spanish but some of the respondents believed the population might view the authorities with distrust and alarm.

For the Carribean population, the Carribean radio station was mentioned as the best possible means of disseminating an evacuation order. Again there was concern about having authorities, usually the police, go through neighborhoods because of a lack of trust. Immigrant groups trust their own people. For the East Asian and Russian Jewish communities, both the regular media and authorities going through neighborhoods were mentioned as good methods for informing them of an evacuation. For the Polish community, television is the key means of transmitting information as many immigrants use this media to learn English. Having authorities going through neighborhoods

would not be a good idea because these immigrants tend to be frightened of police and do not live in concentrated areas. Because social clubs and churches are important to this community, they could serve as intermediaries in disseminating information.

The next point to be considered is whether the immigrant groups would evacuate if notified, and if so what would be their likely destination. Generally, the respondents believed that the Haitian community would evacuate if told to do so. However, a fear of looting might inhibit them from leaving their homes and the middle class perhaps might be reluctant to evacuate. There were major differences among the respondents in their answers as to where the people would go. Some thought that a large percentage of evacuees would go to public shelters while others thought that the vast majority would go to friends or relatives. The two key factors that appear to influence where people will go are: 1) where they are told to go by the authorities (in Palm Beach County and Hallendale people are being encouraged to use public shelters) and 2) whether the immigrants have friends or relatives in the area (few Haitians in South Dade County have family members in the area).

Basically, the respondents from the Hispanic community believed that these individuals would evacuate if ordered to do so. However, they also mentioned that before these individuals would evacuate they would have to trust the source of the message to evacuate and that they would be very concerned about looting. Thus, it might take this population longer to mobilize to

evacuate. Another factor that should be considered is that many Hispanics have boats; it is a status symbol. Therefore, time must be allotted for them to secure their boats and information should be disseminated on how to secure them. The respondents believed that in general this population would evacuate to the homes of family and friends. Public shelters would probably only be used by the elderly who had no relatives in the area and by the poor.

The Jamaican respondents agreed that the population would evacuate but that they would tend to evacuate at the last moment. One of the respondents suggested that emphasizing the safety of the children would increase the percentage of people evacuating. Possible looting was also mentioned as a deterrent to evacuation. This population would evacuate to friends or relatives. They have many friends and it is common for three generations to live in one residence.

According to the representative for the East Asian population, this group would evacuate if so ordered. This group was described as law abiding and docile and would probably evacuate as instructed by the authorities. Thus, the use of public shelters might be higher with this group than with other ethnic groups if authorities recommend the use of public shelters. However, these people would prefer to stay with other people of their own ethnic group if possible.

Both the Polish and Russian population would evacuate, but the former group would be very concerned about leaving behind their personal possessions. Because both of these groups

tend not to have relatives living in the area, the use of public shelters would probably be higher than with other immigrant groups. It can be assumed that these two groups are unaware of the devastation a hurricane can cause and therefore may be slow to react.

Special County Problems

A major problem of Palm Beach County is the large number of immigrants in the Belle Glade area. Most the of these individuals are poor migrant laborers. For the migrants brought in from Jamaica to cut the sugar cane, their employers would take the responsibility of evacuating them if needed. These individuals are housed in cinder block barracks which should be able to withstand the force of a major hurricane. However, a possible problem here would be flooding. For the rest of the immigrants in this area about 50% live in trailers or sub-standard housing; this population of 5,000-6,000 would have to be evacuated. Native speakers who these individuals trust would have to be used to convince them of the seriousness of the situation. They would evacuate to wherever they were told. However, many would need transportation assistance because they depend on the farmers and growers for transportation to and from the fields. It was suggested that the emergency management officials work with the Catholic Church and the various advocacy groups in the area to both educate the population and to develop plans for hurricane evacuation.

Special problems for Dade County include the poor and

migrant laborers in the South Dade area, the multitude of immigrant groups in the county and the vulnerable population in East Little Havana. This does not include the large elderly population on Miami Beach for these tend not to be recent immigrants. Thus, the emergency managers in this county will have to develop specific strategies for each of the immigrant groups. The various methods of educating and warning these groups which were discussed above should prove useful to emergency managers.

The only problem noted in Broward County was that most of the ethnic media, with a few exceptions, is Miami based. Thus, these stations must be alerted that they must be very specific as to what areas are under an evacuation order.

Future Research

Because so little is known about the reactions and behavior of immigrant groups to emergencies in general and to hurricanes more specifically, each of the respondents was asked about the best ways of obtaining further information from their particular group concerning hurricane evacuation. As will be discussed, different methods would have to be used for different groups. Although telephone surveys have typically been used in behavioral studies, this method would not be effective with the Haitian population because they do not trust people outside their own community. Instead, call-in shows on Haitian radio stations and the use of native speakers to interview people right after church would better reach this population. The respondents

believed that the ministers would cooperate in such a venture. These methods were suggested because Haitians are familiar with call-in shows and the churches are very important social gathering places for them. In addition, in the Belle Glade area members of advocacy groups could be interviewed and a survey could be conducted at the "bean dock" where migrants gather to get work. Although there would be questions about the randomness of the sample using these techniques, they appear to be the most feasible in this situation. Given the costs of recruiting and training interviewers, the time needed for face-to-face interviewing, translating problems and the airtime, costs involved in a study with a sample size of 300 from each county could probably be done for approximately \$20,000.

For the Hispanic groups, the respondents believed that telephone surveys with bilingual speakers would be effective. Developing a sample frame would be a problem, but knowledgeable people could be used to indicate areas with high concentrations of Hispanics. Another possible problem is the number of unlisted telephones, but this bias could at least be ascertained by using a Polk Directory. Conducting such a survey with 300 respondents in each county could be done at an estimated cost of \$10,000.

A telephone survey could be done for the East Asian community. A sample could be generated from lists provided by the associations of the various ethnic groups. There is a federation of East Asian groups who would cooperate in accessing these groups. Assuming a sample of 300 from the total region, the study could be conducted for approximately \$5,000.

Both the Jamaican and Russian groups could be interviewed by telephone similar to the procedure used for the East Asian community. Here again a sample frame could be constructed from lists provided by community organizations for the Jamaican community and possibly the Jewish Family Service for the Russian immigrants. The costs for these surveys would be an estimated \$4,000-\$5,000 each.

Surveys would probably not be feasible for the Polish community since it would be difficult to develop a sample frame and the people might be reluctant to respond because of their lack of knowledge about hurricanes. Therefore, interviewing additional key informants would be advantageous and would cost approximately \$1,000.

Given our tremendous lack of knowledge concerning the response of immigrant populations to hurricane threats, the above mentioned research would not only increase our ability to predict the behavior of immigrant groups in Southeast Florida, but also increase our general knowledge of the response of minorities in disaster situations.

MONROE COUNTY BEHAVIORAL ANALYSIS

Since the Florida Keys are geographically unique, special problems exist for predicting hurricane evacuation behavior. In addition to its vulnerability to storm surge and winds, the only main route out of the Keys is U.S. 1. Further, public shelters and motels/hotels will be closed in Monroe County during a Category III or more severe hurricane. In addition, a major hurricane has not directly hit the Keys since the early 1960's. For these reasons, emergency planners in Monroe County must be informed on how residents intend to respond in a hurricane threat. The behavior of Monroe County residents is also of vital importance to other counties in lower Southeast Florida, particularly Dade County since people traveling out of the Keys first travel into Dade. Most importantly, information on the number of people who will evacuate, the number of vehicles on the road, where the evacuees will go, and when they will leave is essential to determine when to issue evacuation orders. This information is also necessary for the planning of public shelter space.

Currently, research on hurricane hazard perception of Florida Key residents has been performed by Cross (1989). He conducted a longitudinal study of hazard perceptions in the Lower Keys during a period when no major hurricanes directly hit the area (1976-1988). In general, residents' view of the danger of hurricane winds and flooding increased during the 12-year period. In 1976, 15.9 percent of the respondents considered

hurricane winds as a "major problem" for the Keys, while in 1982, 20.6 percent felt this way, and this increased to 41 percent in 1988. Furthermore, the percentage of respondents who considered hurricane winds as "not a problem at all" decreased from 23.8 percent to 12.7 percent to 3.3 percent from 1976 to 1988. However, it must be taken into consideration that the original sample in 1976 consisted of 525 respondents, and the final sample in 1988 consisted of a remaining 61 respondents because of attrition (e.g. death, relocation, refusal to participate).

Other research was conducted by Post, Buckley, Schuh & Jernigan, Inc. in the Lower Southeast Florida Hurricane Evacuation Study (1983). This study provided information to emergency management on probable hurricane response of residents in the four-county area of Dade, Broward, Palm Beach, and Monroe. Post, et al. analyzed the pre-planned destinations of evacuees, the number of households that would require transportation and other assistance, the number of vehicles evacuees would use, evacuation response times, and past hurricane experience.

The current study focused exclusively on Monroe County updating the results of the 1983 analysis. Behavioral information was obtained concerning both a hypothetical Category II and Category III hurricane situation. This information is essential for Monroe County because public shelters and motels/hotels are not open during a Category III or more severe hurricane. Data was collected on evacuation rates, timing, destination, type of refuge and vehicle usage.

Methodology

Approximately 100 respondents were randomly selected from the Upper, Middle, and Lower Florida Keys (308 total). This division was based upon the Hill-Donnelly Cross Reference Directory for the Keys and approved by the Civil Defense Director for Monroe County. The Upper Keys consisted of Key Largo through Long Key; the Middle Keys consisted of Conch Key through Marathon; and the Lower Keys consisted of Bahia Honda Key through Key West.

Respondents were interviewed by telephone during July, 1989, and were required to be in residence in the Keys during the hurricane season. After three failed attempts on successive days to contact a respondent, a telephone number of an adjacent residence was selected. This process was also used if the respondent was not a resident during the hurricane season, if the number was disconnected, or if he/she refused to participate in the study. Military personnel and their dependents (approximately 5,000) are provided shelter by the federal government although they are not required to use it. They may seek refuge at a public shelter, leave the area, etc. Therefore, if military personnel indicated that their family would go to a federal government shelter, they were excluded from the sample.

Each respondent was presented with two situations; one involving a Category II hurricane and the other involving a Category III hurricane. Half of the respondents received the Category II situation first and half of the respondents received the Category III situation first in order to counterbalance for

order effects. A copy of the survey is included in Appendix B. The survey required for this study was the Behavioral Analysis Survey in Support of Hurricane Evacuation Studies as approved by the Office of Management and Budget (OMB). Only minor modifications to this model survey were permitted.

RESULTS

Sample Size and Confidence Interval

It is often not feasible to survey the entire population in a specific area in order to assess its probable evacuation behavior. Because of this, a sample or sub-group of that population is generally surveyed. Based on data collected from the sample group, results are then generalized back to the target population. Because the population is not completely represented in the sample group, the resulting statistics (e.g. percentages, means) are not entirely accurate. This inaccuracy is present in all sample statistics and is called sampling error. Sampling error is a function of the sample size and therefore can be calculated for various sample sizes. The size of the population from which the sample is drawn, however, has no effect on the sampling error.

A confidence interval is typically used to present sampling error and represents the area around the sample statistic in which the true population statistic occurs with a certain degree of confidence. In other words, if a sample of 100 respondents is surveyed, one can be 90 percent confident that the true population response (in percent) would occur within ± 8.25

percent of the obtained sample response. Therefore, if the sample survey indicated that 50 percent of the respondents would evacuate in a Category IV hurricane, then one could be 90 percent confident that the true population response would fall between 41.75 percent and 58.25 percent; that is, 50 percent ($\pm 8.25\%$). Listed below are confidence intervals for various sample sizes. These may be used to assess the relative accuracy of the various percentages contained within this report by comparing the sample sizes given here to those presented with each table or figure.

Confidence Intervals for Various Sample Size*

<u>Sample Size</u>	<u>Level of Confidence</u>	<u>Confidence Interval</u>
50	90%	$\pm 11.67\%$
100	90%	$\pm 8.25\%$
200	90%	$\pm 5.38\%$
300	90%	$\pm 4.76\%$

*Note: These confidence intervals are based on the greatest amount of error that might occur which happens when there is a 50% - 50% split in the data. As the distribution moves toward the extremes (e.g. 90% - 10% split), the confidence interval decreases.

Order Effects

In half of the interviews, the Category II scenario was presented before the Category III scenario. In the other half of the interviews, the order was reversed. This was done to examine whether those surveyed changed their responses in the second scenario as a consequence of the first scenario. A chi-square indicated that no order effects occurred in the data ($\chi^2 (1) = .524$, n.s.). Hence, the data from the two orders were combined for all further analyses.

Type of Housing

Overall, 54.5 percent of those surveyed reside in single-family homes, and 18.8 percent live in mobile homes. Since mobile homes are particularly vulnerable to hurricanes, it is important to note that only 10.8 percent of the Lower Key residents live in mobile homes. In the Middle and Upper Keys, this percentage increases to 21 percent and 24.5 percent, respectively (see Summary of Responses in Appendix C).

Evacuation Rates

In both a Category II and a Category III hurricane threat, there was a general trend for the respondents in the Lower Keys to be less likely to evacuate than those in the Middle and Upper Keys.

Total Evacuation Rates by Household

<u>Keys</u>	<u>Category II</u>	<u>Category III</u>
Upper Keys	69.8%	78.3%
Middle Keys	65.0%	76.0%
Lower Keys	43.1%	55.9%

Presented with a Category II hurricane threat 36 hours from landfall, a hurricane watch issued, and a voluntary evacuation recommended, 42.5 percent of the respondents in the Upper Keys, 37 percent in the Middle Keys, and 19.6 percent in the Lower Keys indicated they would evacuate. With a warning issued at 24 hours and an evacuation ordered, an additional 19.8 percent (Upper), 25 percent (Middle), and 18.6 percent (Lower) indicated they would evacuate. At 12 hours with a warning and evacuation order still in effect, a further 7.5 percent (Upper), 3 percent (Middle), and 4.9 percent (Lower) indicated they would evacuate. Therefore, a total of 69.8 percent (Upper), 65 percent (Middle), 43.1 percent (Lower) would probably evacuate during a Category II storm. It should be noted that evacuation was defined as leaving their residence to seek safer refuge.

Presented with a Category III situation at 36 hours from landfall, the percentage of households evacuating increased to 50.9 percent (Upper), 57 percent (Middle), and 29.4 percent (Lower). With a warning being issued at 24 hours and an evacuation ordered, an additional 18.9 percent (Upper), 14 percent (Middle), and 21.6 percent (Lower) indicated they would

evacuate. At 12 hours, a further 8.5 percent (Upper), 5 percent (Middle), and 3.9 percent (Lower) would probably evacuate. Therefore, 78.3 percent (Upper), 76 percent (Middle), 55.9 percent (Lower) would probably evacuate during a Category III hurricane.

Evacuation Timing

Respondents were asked, "Taking into consideration how long it would take you to get ready to leave, when would you leave?" This question refers to how long it will take a person to get ready once he/she has made the decision to evacuate whether it be in response to a 36 hour watch, 24 warning, or 12 hour warning. In a Category II condition, an average of 32.8 percent of the probable evacuees said "immediately," 34.4 percent said "between 1 and 3 hours," 17.9 percent said "between 3 and 6 hours," 10.8 percent said "6 hours or more," and 4.1 percent said "don't know." In a Category III condition, an average of 28.6 percent said "immediately," 36.1 percent said "between 1 and 3 hours," 19.2 percent said "between 3 and 6 hours," 11.6 percent said "6 hours or more," and 4.5 percent said "don't know." Specific percentages for the Upper, Middle, Lower Keys are presented in the "Summary of Responses" (Appendix C). Behavioral response curves presenting the cumulative evacuation timing by household are shown in Figures 1-8. These curves represent percentage of households evacuating at each stage of the evacuation process. In a Category III storm, within 1 to 3 hours after a 36 hour notice, 44.7 percent of the evacuating households plan to

Figure 1

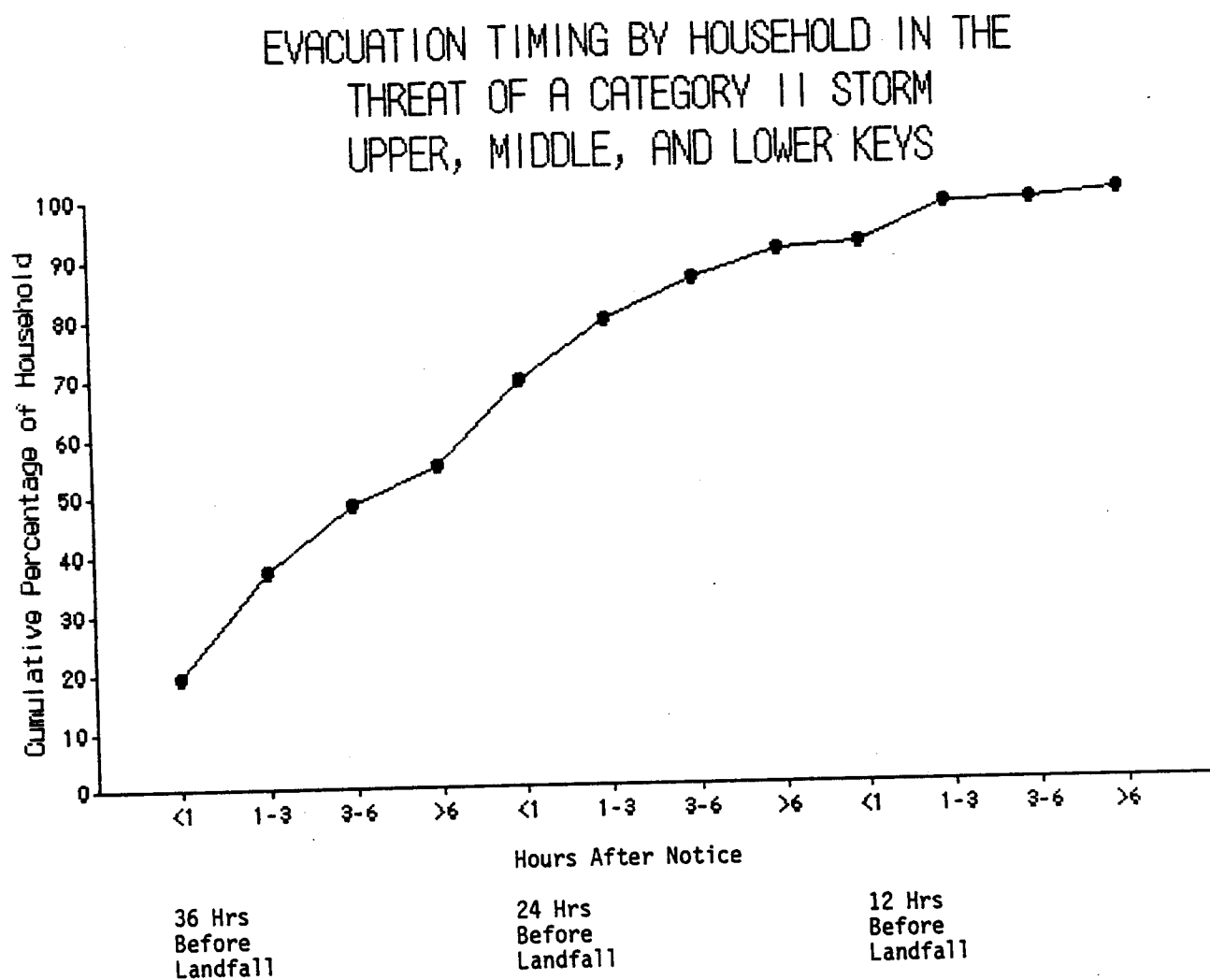


Figure 2

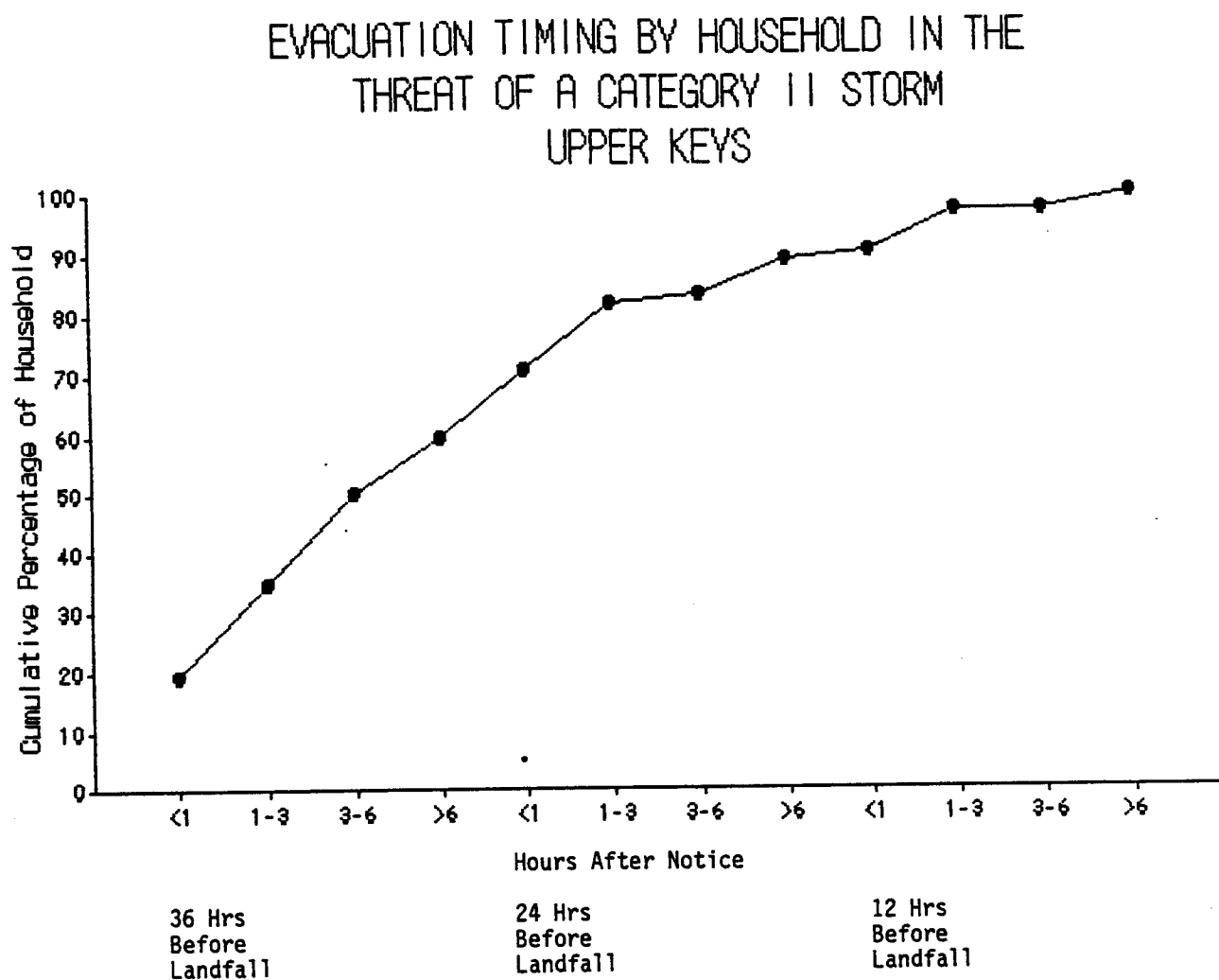


Figure 3

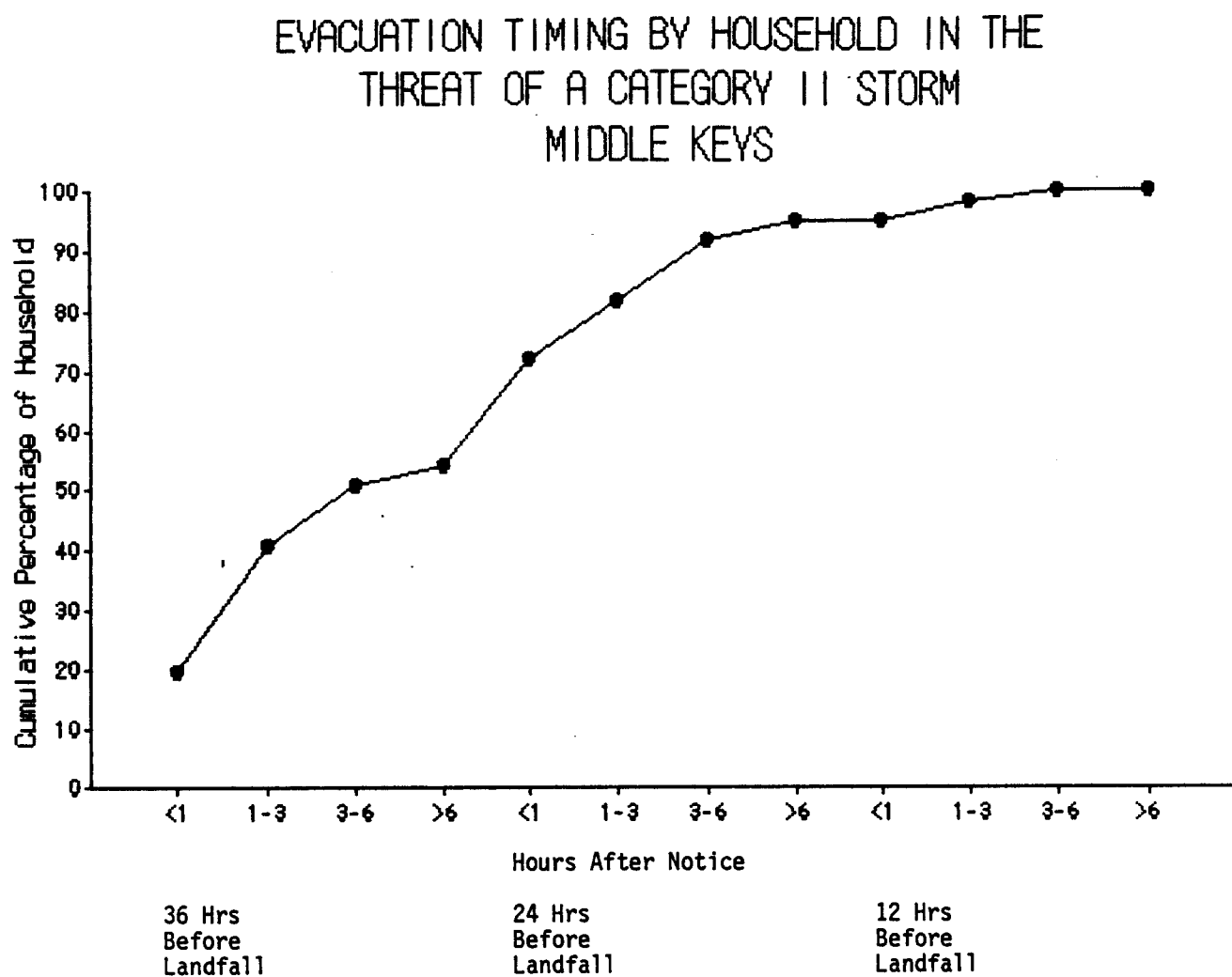


Figure 4

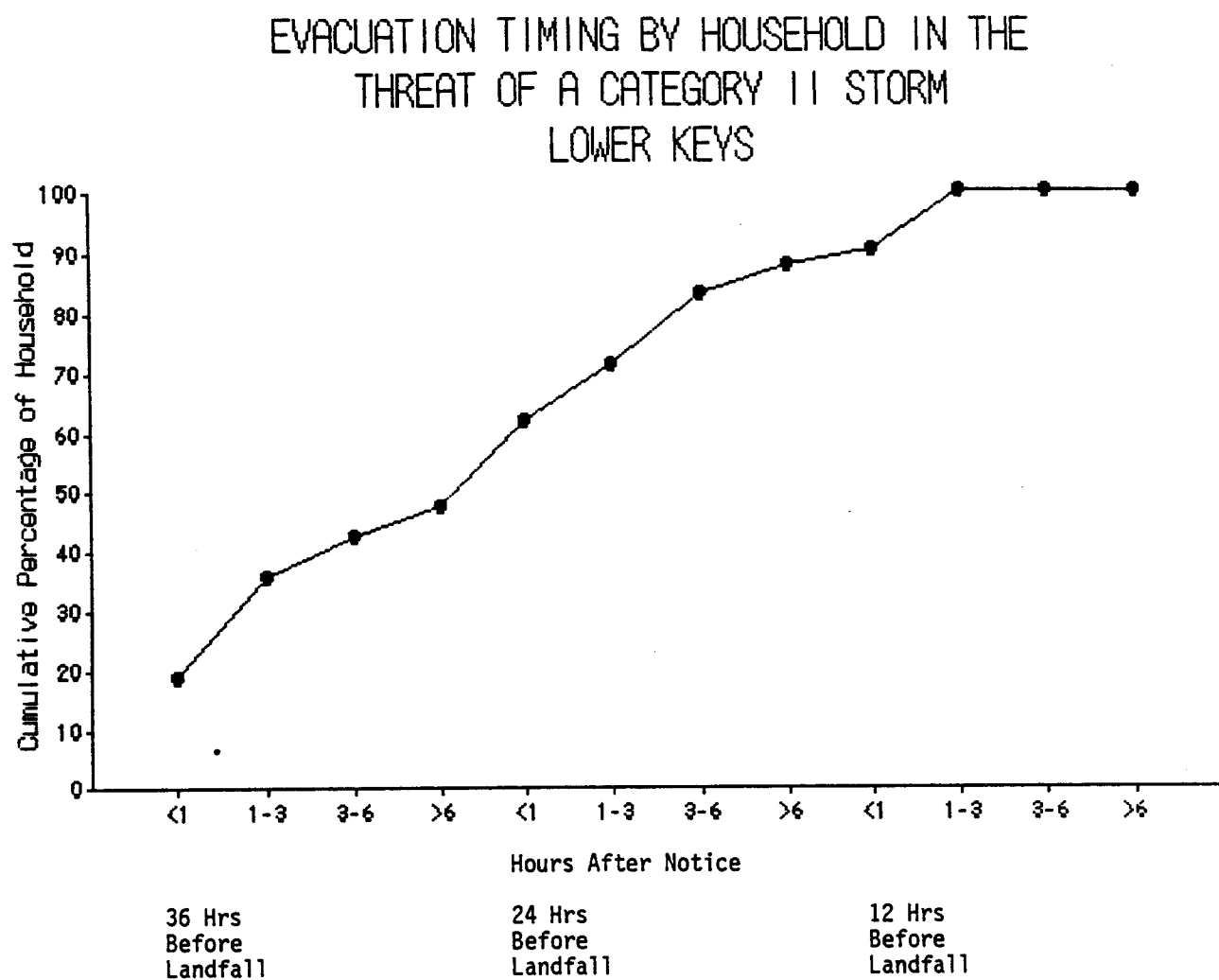


Figure 5

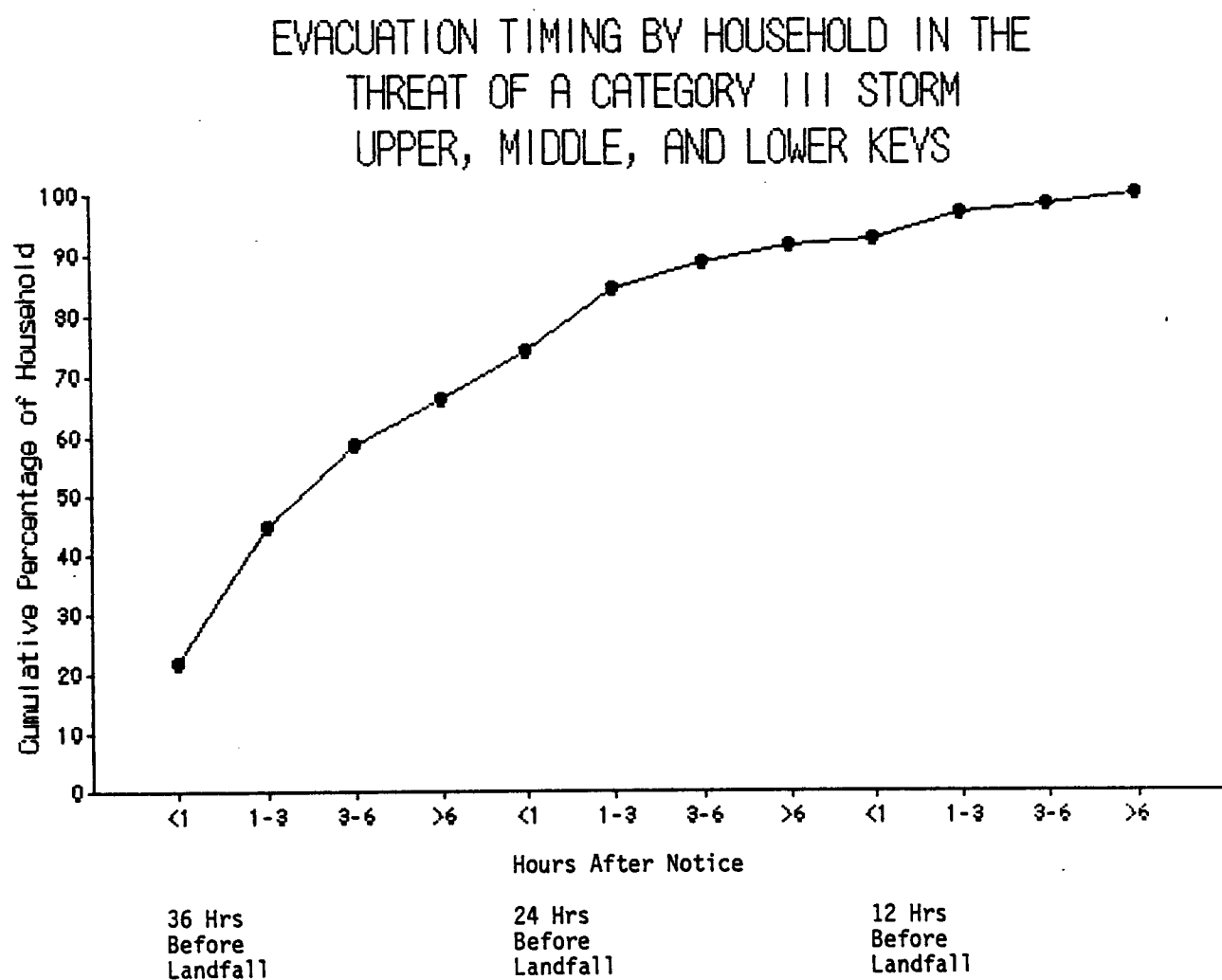


Figure 6

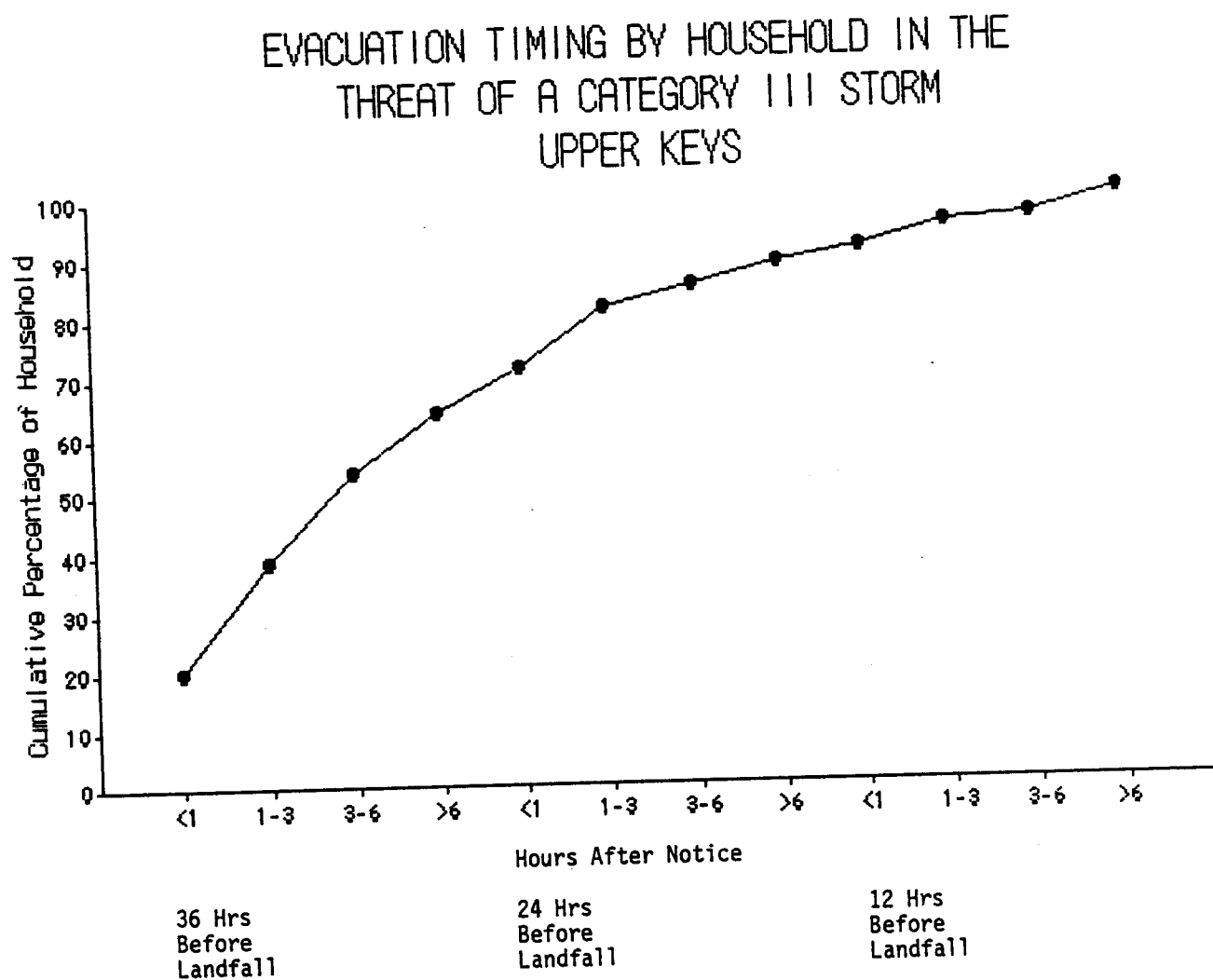


Figure 7

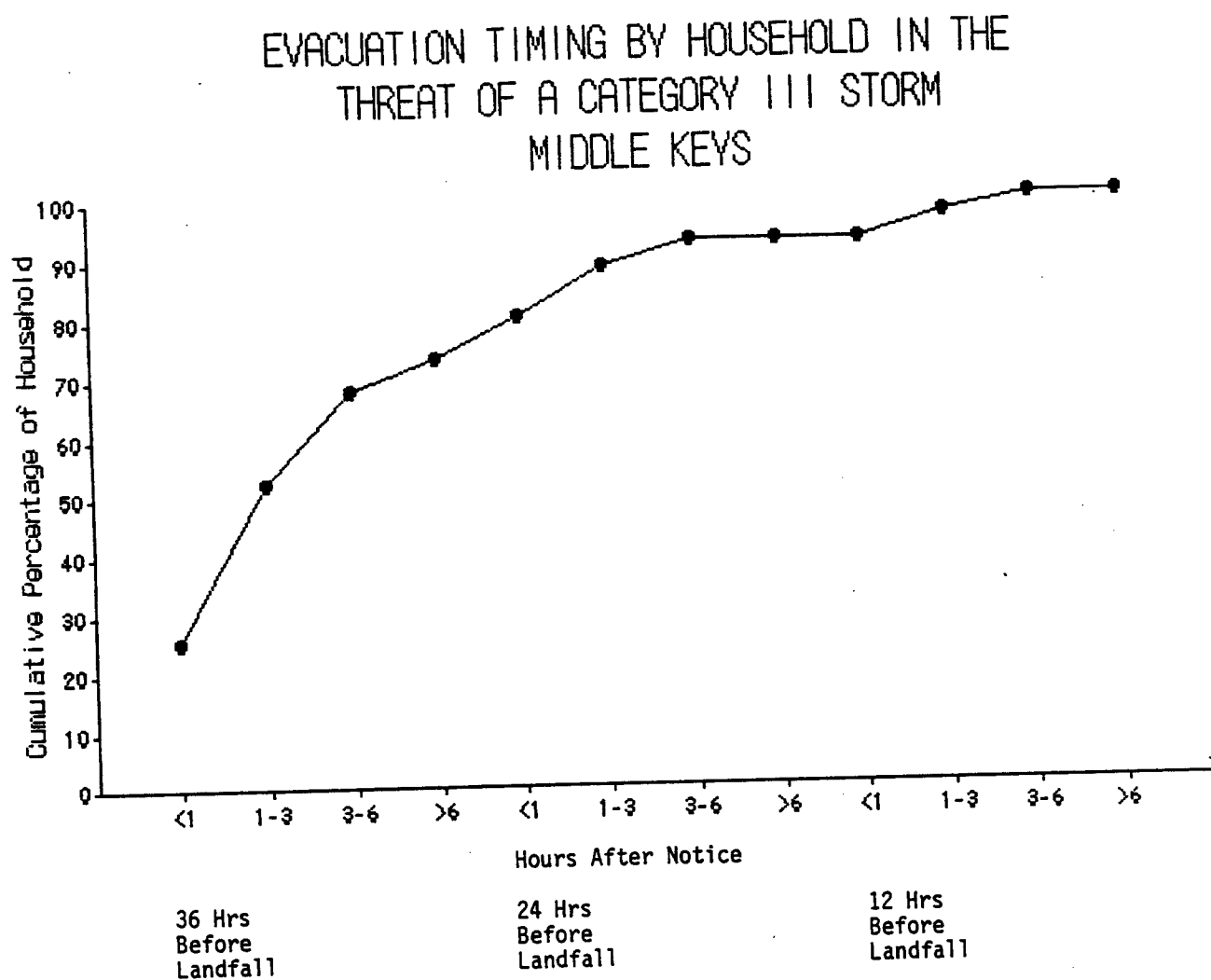
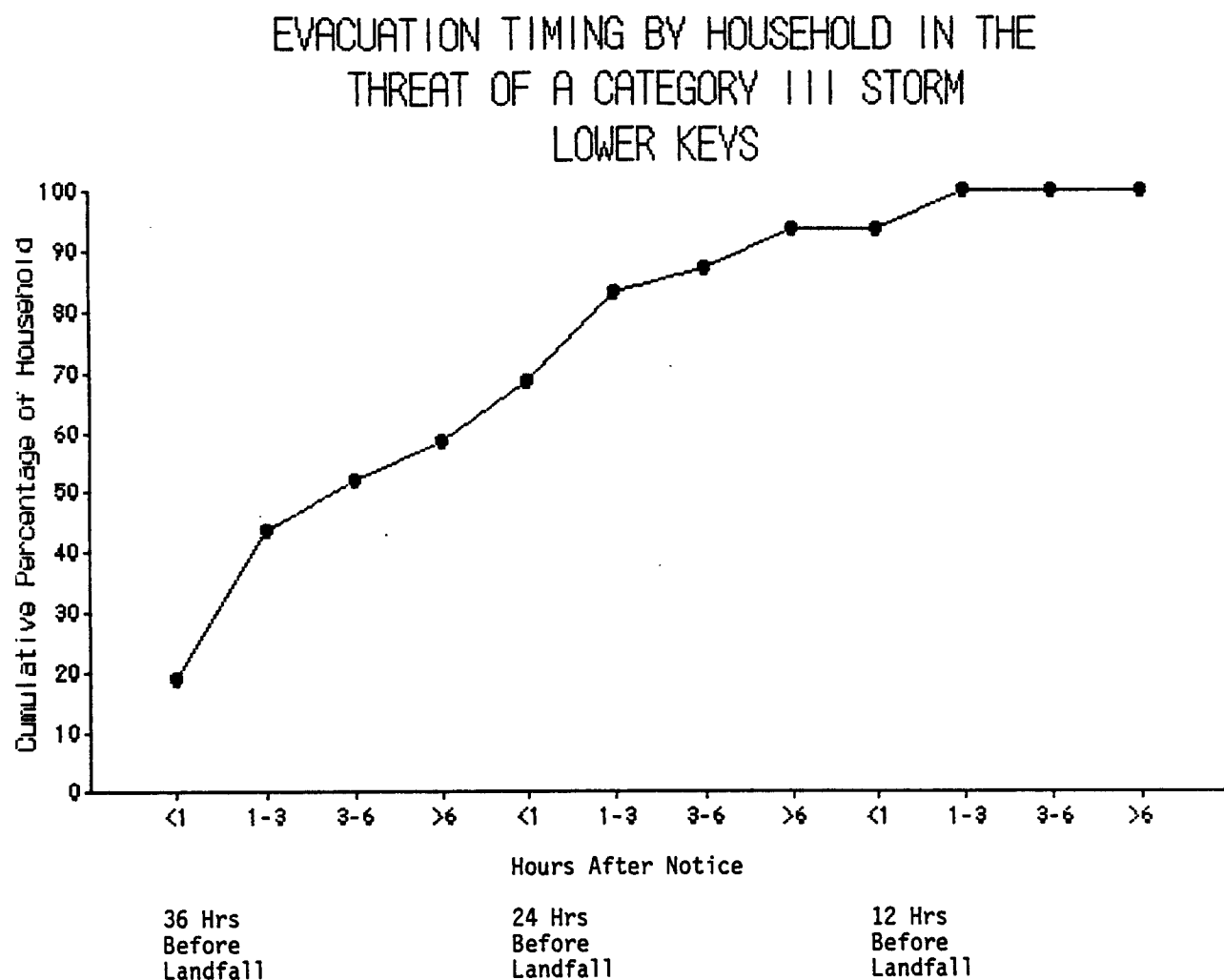


Figure 8



evacuate. By 3 to 6 hours after a 24 hour warning, 88.5 percent of the households planning to evacuate would have left (see Figure 5). In a Category II hurricane, 48.5 percent of the evacuating households plan to evacuate within 3 to 6 hours after a 36 hour notice and 86.3 percent within 3 to 6 hours after a 24 hour warning (see Figure 1).

Type of Refuge

Respondents who indicated that they would evacuate were then asked whether they would go to a public shelter, the home of a friend or relative, a motel, or some other place. Presented with the Category II scenario, 51.3 percent of the probable evacuees in the Upper Keys indicated they would go to a friend or relative. In the Middle Keys 44.1 percent and 34 percent in the Lower Keys indicated they would go to a friend or relative. The percentage of respondents who indicated they would go to a motel was quite similar throughout the Keys: 23.1 percent (Upper), 26.5 percent (Middle), and 24 percent (Lower). However, only 5.1 percent of those evacuating in the Upper Keys said they would go to a public shelter compared to 16.2 percent in the Middle Keys and 32 percent in the Lower Keys. Of those who said they would go somewhere else, the most frequent response was a second home or a family-owned business. Similar percentages were found when respondents were presented with a Category III situation. Exact percentages are shown in the "Summary of Responses." Those who indicated that they would go to a public shelter or motel/hotel in Monroe County in a Category III storm

were then informed that public shelters will be closed in Monroe County and motels will also be requested to close.

Destination and Routes

In both a Category II and a Category III situation, those respondents who intended to evacuate were consistent in their responses regarding in which city and county they planned to seek refuge. However, the destination of those in the Upper, Middle, and Lower Keys varied considerably. For example, of those surveyed in the Upper Keys, approximately 48 percent said they would go to Miami (Dade County), while 34.3 percent of those in the Middle Keys and 31 percent of those in the Lower Keys would go to Miami. Homestead (Dade County) was the destination indicated by 11.5 percent of the evacuees from the Upper Keys, 6 percent from the Middle Keys, and 0 percent from the Lower Keys. Also, the percentages differed greatly between the Upper, Middle, and Lower Keys for those who planned to evacuate their home but to remain in Monroe County. Only 12 percent in the Upper Keys plan to evacuate locally, but 24 percent in the Middle Keys and 40 percent in the Lower Keys plan to evacuate locally (i.e. remain in Monroe County).

The majority of evacuees would use U.S. 1 since it is the main route out of the Keys: 91 percent of evacuees from the Upper Keys, 87 percent from the Middle Keys, and 84 percent from the Lower Keys. Local roads would of course be utilized by those who plan to evacuate but remain in Monroe County. Usage of local roads in the Lower Keys varies from 20 percent in a

Category II condition to only 7 percent in a Category III hurricane threat (see Summary of Responses, Appendix C).

Vehicle Use

When asked, "How many cars or other vehicles do you have at your household," 62 percent of those planning to evacuate indicated they had two or more vehicles. However, it is interesting to note that 75 percent of them would use only one vehicle to evacuate, 19 percent would use two vehicles, 5 percent would use three vehicles, and .4 percent (one respondent) would use four vehicles. Approximately 7 percent of those evacuating would be pulling a trailer and only one respondent would be taking a motorhome.

For the transportation analysis, it is necessary to indicate when evacuees will be leaving their residences. This was plotted in behavioral response curves presenting the cumulative number of vehicles on the road in response to the 36 hour watch, 24 hour warning and continued 12 hour warning for both the Category II and Category III hurricane scenarios (Figures 9-16). Figure 9 shows that in a Category II storm, approximately 55 percent of the vehicles that will be used by the evacuees will be on the road within 6 hours after notice of a 36 hour watch. At this same time in a Category III storm, almost 70 percent of the vehicles will be on the road (see Figure 13). In both a Category II and Category III storm approximately 90 percent of the vehicles expected to be used will be on the road within six hours after the 24 hour warning.

Figure 9

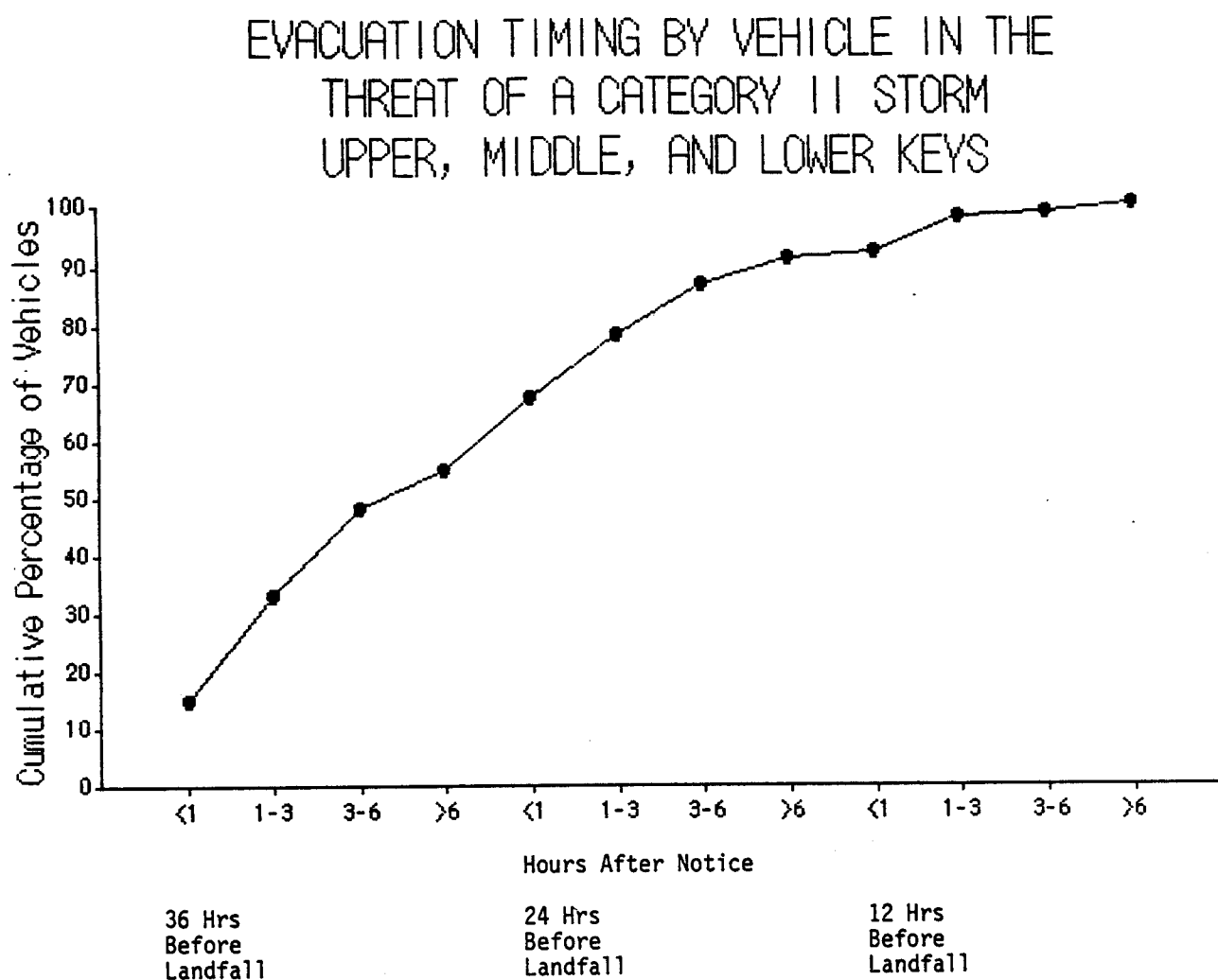


Figure 10

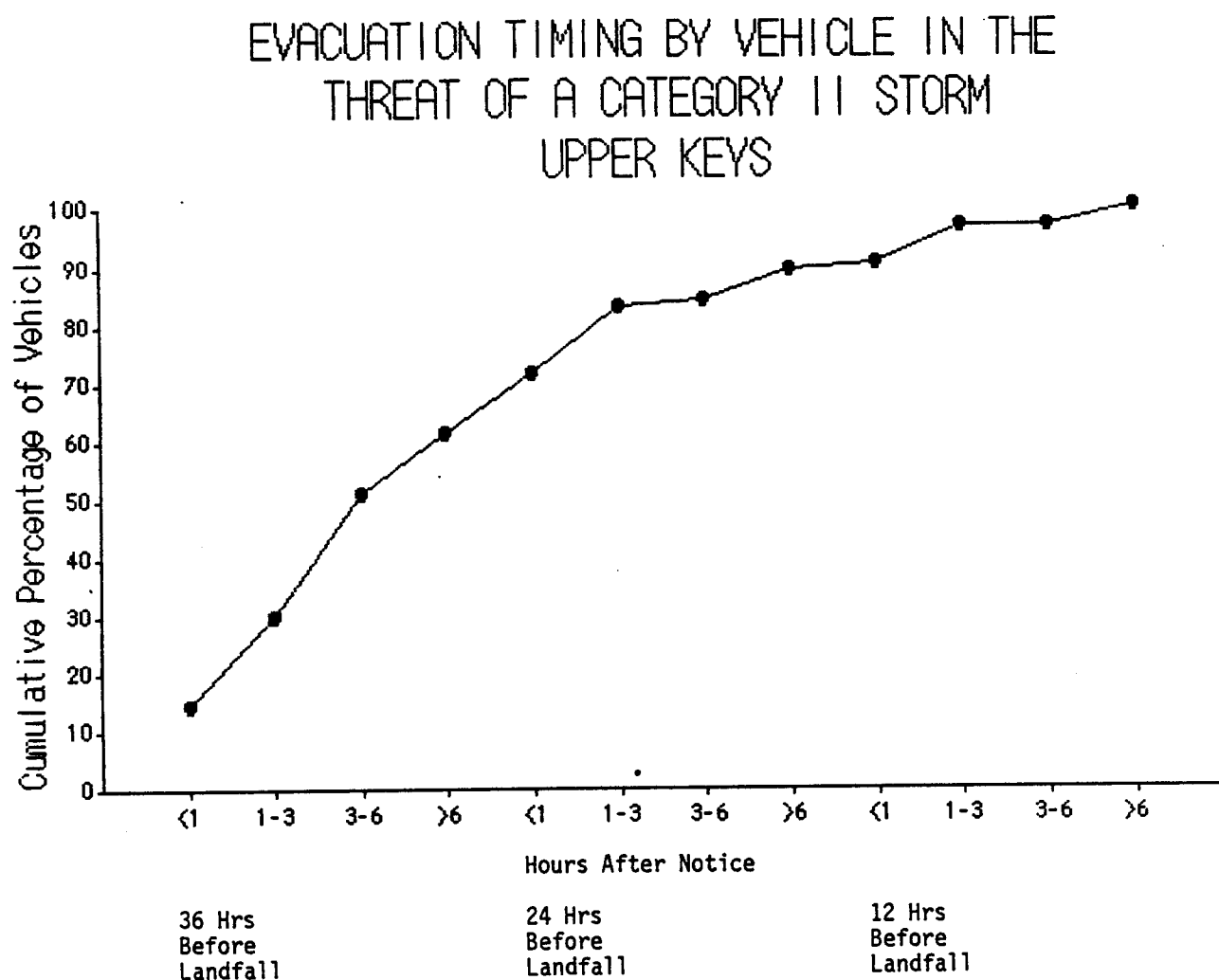


Figure 11

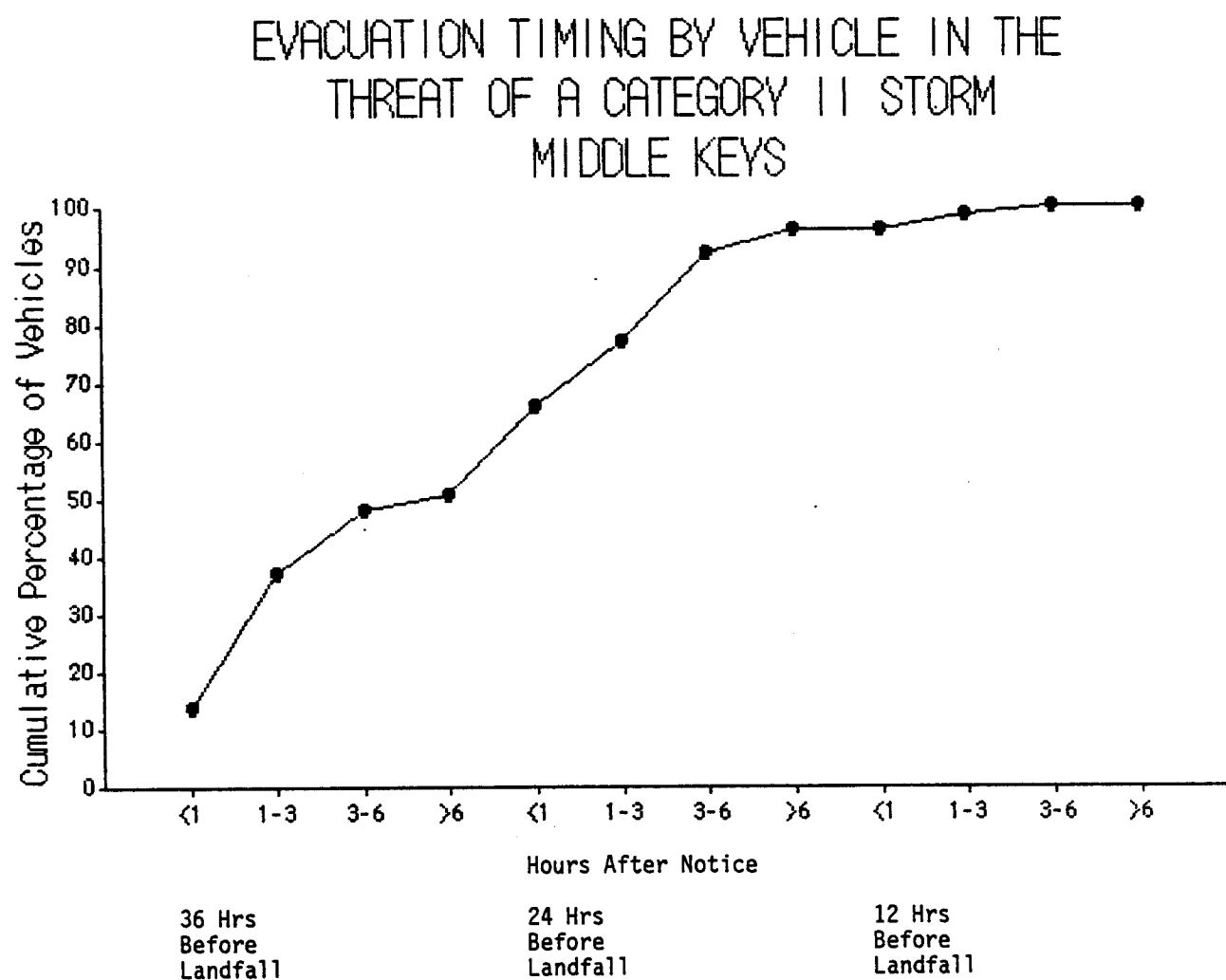


Figure 12

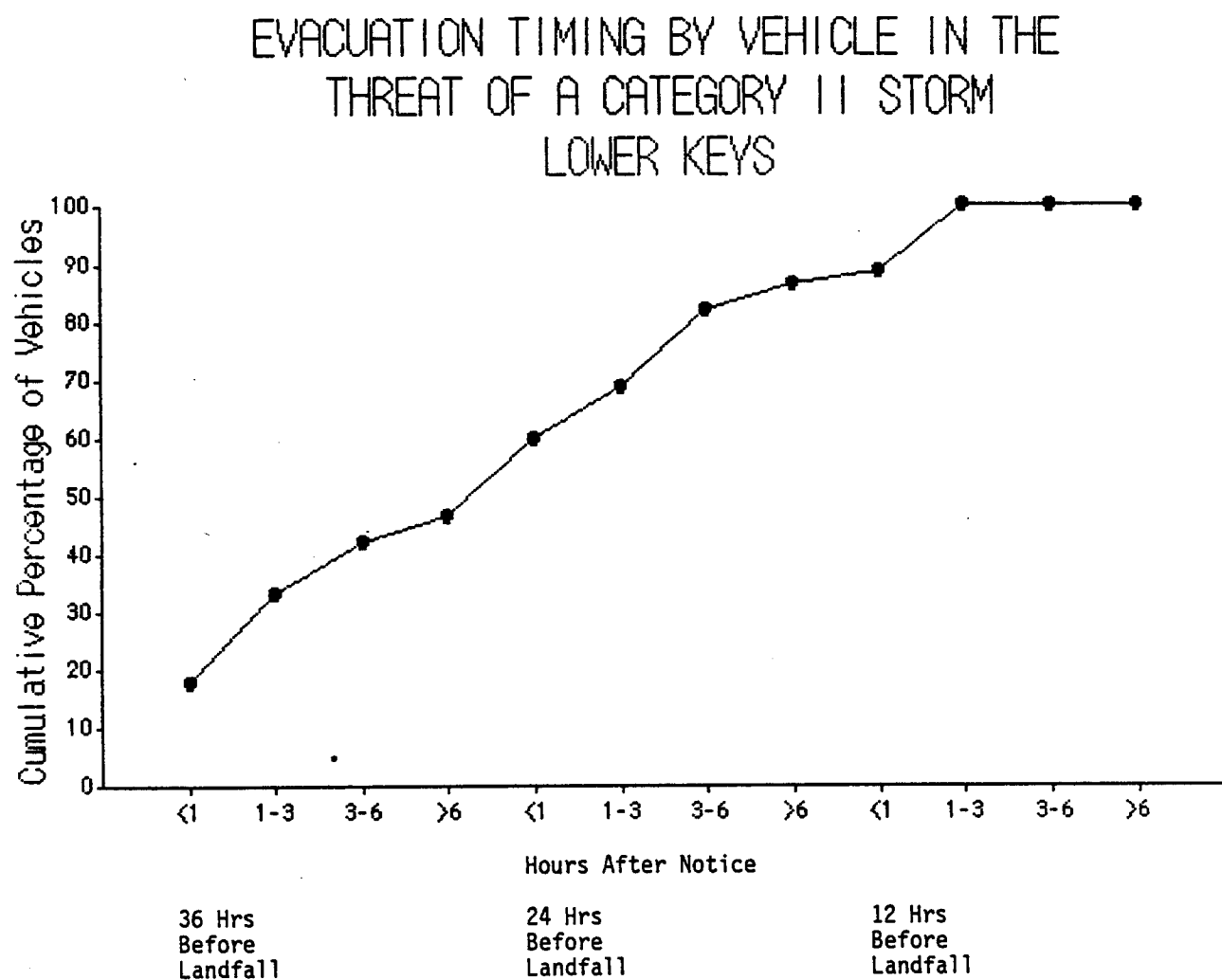


Figure 13

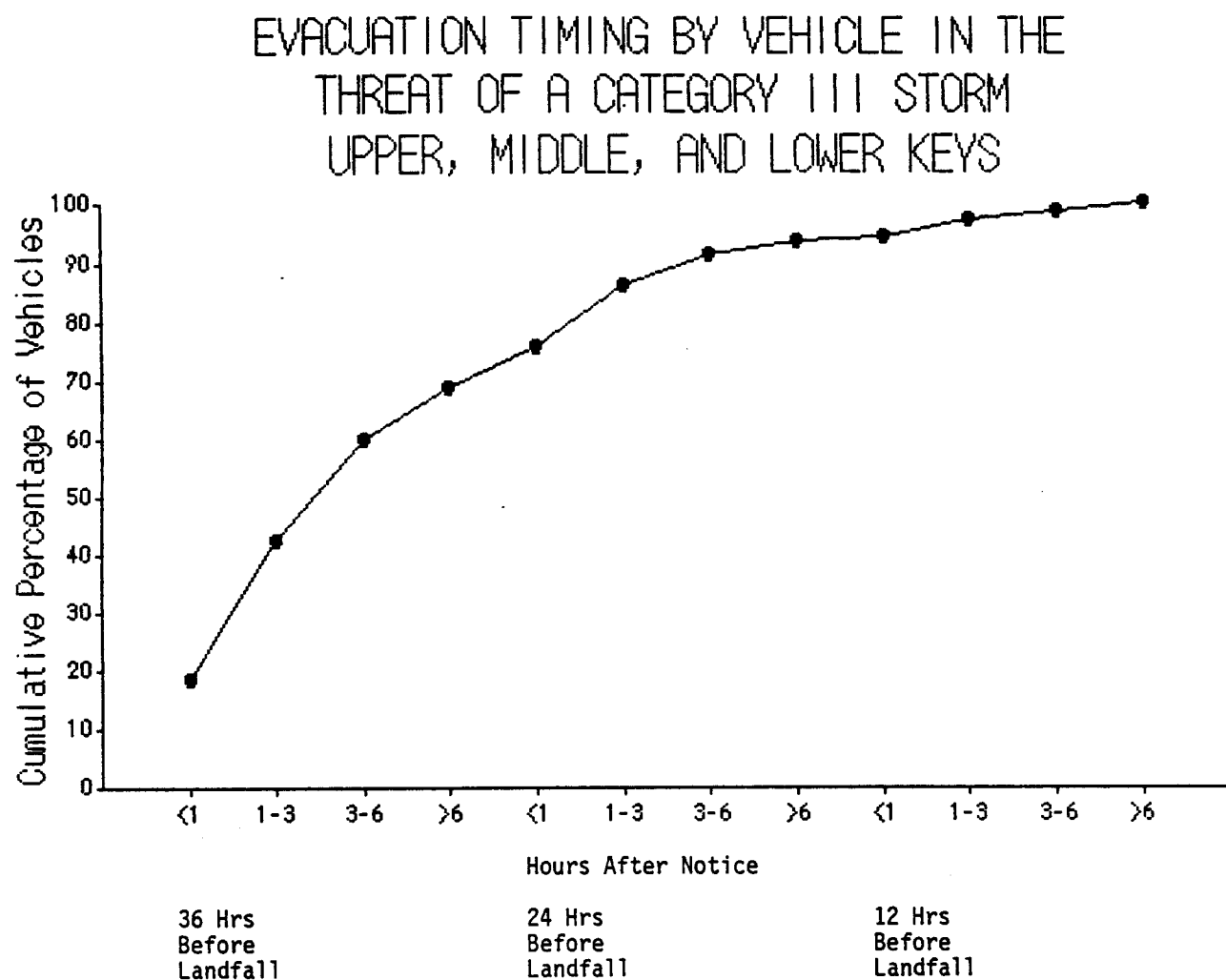


Figure 14

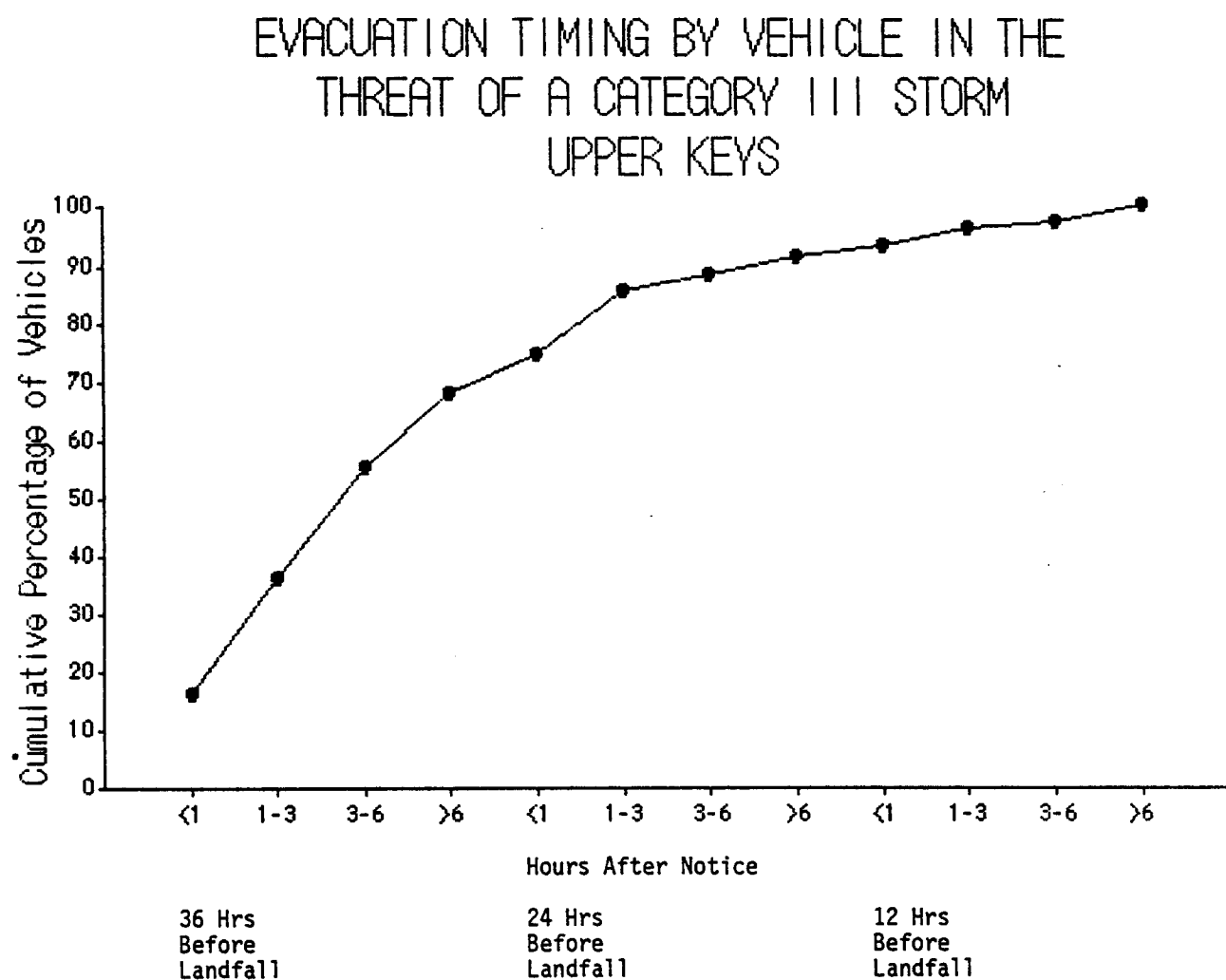


Figure 15

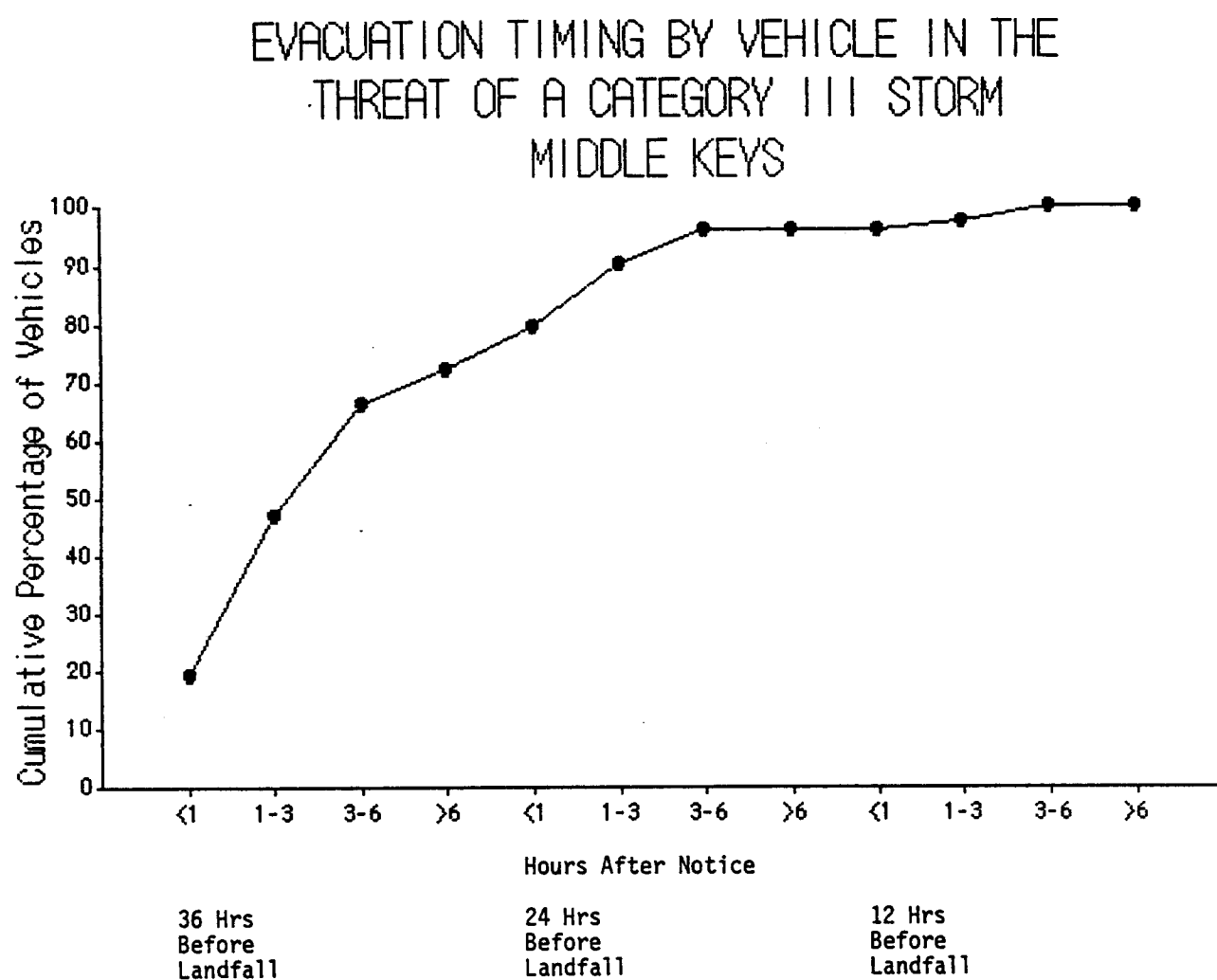
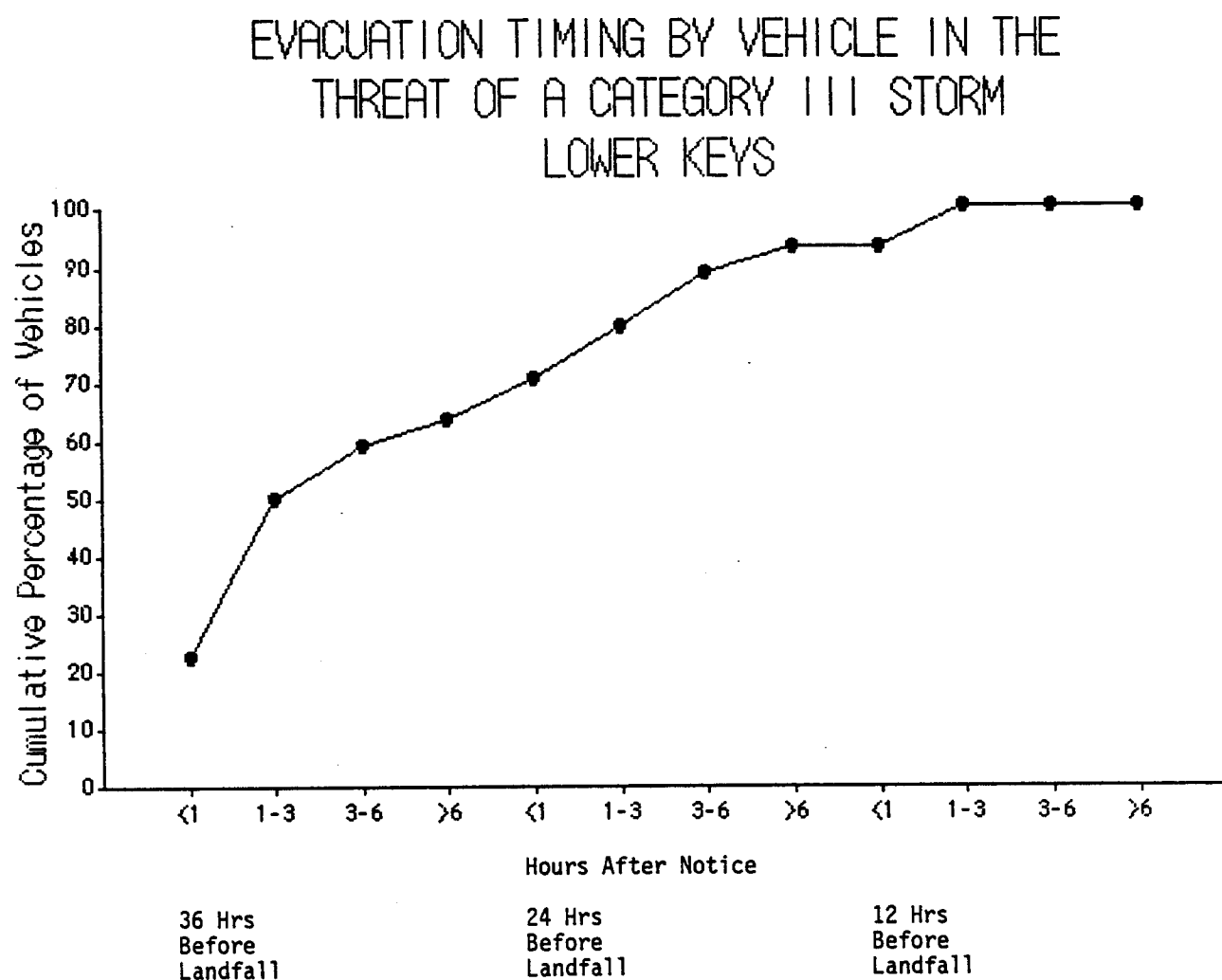


Figure 16



CONCLUSION

In an effort to determine whether expected evacuation behavior has changed, the results from the current study were compared to the results of the 1983 study. To the extent that both studies provide similar results, the confidence in the results of both studies increases. It should be noted, however, that the 1983 study was divided by Upper and Lower Keys and the present study was divided by Upper, Middle, and Lower Keys.

Similarities include the following:

1. Residents surveyed in the Lower Keys would be less inclined to evacuate than the other areas surveyed.
2. Of those planning to evacuate to the home of a friend or relative or to a motel, 74 percent would go to either Dade County or out of the four-county region (Dade, Broward, Palm Beach, and Monroe) in the 1983 study. This percentage was similar to that found in the current study (80.7 percent in a Category II and 82.2 percent in a Category III).
3. Upper Key respondents would be more likely to leave Monroe County than the residents of the other Keys.
4. A greater percentage of residents live in mobile homes in the Upper and Middle Keys than in the Lower Keys. In addition, a greater percentage of Lower Key residents live in single-family houses than the other areas.
5. Upper and Middle Key residents have and will use more cars per household than Lower Key residents.
6. Overall less than 20 percent of the evacuees would require

public shelter space. However, a far greater proportion of this space must be allocated to the Lower Keys. Also, many more respondents in the Upper and Middle Keys said they would go to the home of a friend or relative than did those in the Lower Keys.

Note: The 1983 study included those not evacuating in their percentages of destination information. Therefore, it was necessary to deduct the non-evacuees and recalculate their percentages in order to compare their results with those of the current survey.

A major difference between the 1983 study and the current study involves previous hurricane experience. In 1983 about 50 percent of the residents surveyed indicated they had been in a hurricane threat before. In the recent survey approximately 91 percent said they had experienced a hurricane threat and almost 80 percent said they were living in the Keys at the time. This increase was due to Hurricane Floyd in 1987. Almost 59 percent of the respondents were living in the Keys when Hurricane Floyd hit that area. Eighty-eight percent of those who evacuated in Hurricane Floyd indicated that they would evacuate in a future Category II hurricane threat, while only 41.8 percent of those who did not evacuate in Hurricane Floyd felt this way. Furthermore, in a future Category III threat, 92.8 percent of those who evacuated in Floyd and only 57.3 percent of those who stayed in Floyd intend to evacuate. Hence, in our sample, those who evacuated in Floyd were more likely to indicate an intent to evacuate in the future than those who stayed in Floyd.

As previously mentioned, the Florida Keys are uniquely vulnerable to a hurricane threat. In addition, there is only one main route out of the Keys. During the telephone interviews with residents who did not plan to evacuate, the primary reason mentioned was fear of being stranded on U.S. 1. Of course, the closer the storm, the greater the fear of leaving their homes and getting on the highway. This was a global concern but expressed particularly by those living in the Lower Keys. Therefore, evacuation timing should be carefully considered and people in this area should be encouraged to evacuate early.

Another reason for not evacuating that was mentioned frequently involves misperceptions of hurricane experience. Many of the residents of the Keys feel they have experienced the effects of a major storm (Floyd) and therefore can withstand any future hurricane threat. It should be noted that Hurricane Floyd was only a minimal Category I storm. Obviously, there is need for educating and informing the people of the devastation that can be caused by a major hurricane.

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APPENDIX A
IMMIGRANT'S QUESTIONNAIRE

1. Where do they live?
2. What type of housing do they live in?
3. How would you inform them to evacuate?
4. Would they evacuate?

5. Where would they go?
6. What kind of vehicles would they take? Would they need assistance?
7. What would be the best ways to educate them concerning hurricane preparedness and procedures?
8. What would be the best way to obtain further information from this group concerning hurricane evacuation (i.e., Would they respond to a survey? Do they have telephones? Would we need native speakers as interviewers?)?

Hurricane Evacuation Behavioral Analysis Survey

Code _____

Area _____ (Upper, Middle, Lower) Key _____ (Name)

Interviewer _____ (First Name) Date _____

Phone No. _____

Attempt No. 1 2 3

Date of Attempt _____

Time of Attempt _____

Result of Attempt _____

Person and Time to Call Back _____

Hello, I am _____ from the University of South Florida and we are conducting a study of hurricane evacuation for the U. S. Army Corps of Engineers. Would you please take a few minutes to answer some questions about what you would do if a hurricane threatened your area? All your responses will be anonymous.

1. Is this your phone number _____?

Yes _____ [Go to Q 1a]

No _____ [Terminate]

1a. Do you live at this residence?

Yes _____ [Go to Q 2]

No _____ [Go to Q 1b]

1b. When will the residents be there?

Day _____

Time _____

Thank You For Your Assistance

[Terminate]

2. First of all, do you live here year-round? _____ Yes [Go to Q 3]
 _____ No [Go to Q 2a]

2a. Do you usually live here during the hurricane season, from June 1 to November 30th?

_____ Yes [Go to Q 3]
 _____ No [TERMINATE]

3. What type of home or building do you live in?

_____ High rise condo or apartment building 6 stories or greater
 _____ Low rise condo or apartment building 5 stories or less
 _____ Single family home
 _____ Duplex or triplex
 _____ Mobile home
 _____ Other, please specify _____

3a. Is your home elevated? _____ Yes
 _____ No

SCENARIO A. Please listen to the following situation. A Category II hurricane of 100 mph winds is in the Carribean or the Gulf moving toward the Keys and probably will not hit your area for 36 hours. A hurricane watch has been issued and local officials have only recommended a voluntary evacuation.

4. Which of the following would you do?

- _____ All in household would evacuate or probably would. [Go to Q7]
 _____ Some would leave then, others wouldn't. [Go to B]
 _____ Wouldn't evacuate. [Go to B]
 _____ Don't know. [Go to B]
 _____ Other. _____ [Go to B]

SCENARIO B. Now suppose the same hurricane is closer, 24 hours away, and the Hurricane Center has issued a warning. Local officials have ordered an evacuation.

5. What would you do?

- _____ All in household would evacuate or probably would. [Go to Q7]
 _____ Some would leave then, others wouldn't. [Go to C]
 _____ Wouldn't evacuate. [Go to C]
 _____ Don't know. [Go to C]
 _____ Other. _____ [Go to C]

SCENARIO C. Now suppose the same hurricane is even closer, 12 hours away, and the Hurricane Center has continued its warning. Local officials are still ordering an evacuation.

6. What would you do?

- _____ All in household would evacuate or probably would. [Go to Q7]
 _____ Some would leave then, others wouldn't. [Go to Q7]
 _____ Wouldn't evacuate. [Go to D]
 _____ Don't know. [Go to D]
 _____ Other. _____ [Go to D]

7. Would everyone in your household who is evacuating go to the same place?

_____ Yes
 _____ No

8. Where do you think your group (and the other group) would go?

GROUP 1

- _____ Friend's/Relative's
 _____ Motel
 _____ Public Shelter
 _____ Other

GROUP 2

- _____ Friend's/Relative's
 _____ Motel
 _____ Public Shelter
 _____ Other

9. In what city and county is it (are they) located?

GROUP 1

GROUP 2

10. What route(s) would be taken to get there?

GROUP 1

GROUP 2

11. How many people would probably be in the group(s)?

GROUP 1

GROUP 2

12. Taking into consideration how long it would take you to get ready to leave, when would you leave?

GROUP 1

GROUP 2

____ Immediately
____ Between 1 and 3 hours
____ Between 3 and 6 hours
____ 6 hours or more
____ Don't know

____ Immediately
____ Between 1 and 3 hours
____ Between 3 and 6 hours
____ 6 hours or more
____ Don't know

SCENARIO D. Now, please listen to a different situation. A Category III hurricane of 120 mph winds is in the Carribean or the Gulf moving toward the Keys and probably will not hit your area for 36 hours. A hurricane watch has been issued and local officials have only recommended a voluntary evacuation.

13. Which of the following would you do?

____ All in household would evacuate or probably would. [Go to Q16]
____ Some would leave then, others wouldn't. [Go to E]
____ Wouldn't evacuate. [Go to E]
____ Don't know. [Go to E]
____ Other. _____ [Go to E]

SCENARIO E. Now suppose the same hurricane is closer, 24 hours away, and the Hurricane Center has issued a warning. Local officials have ordered an evacuation.

14. What would you do?

- ☐ All in household would evacuate or probably would. [Go to Q16]
☐ Some would leave then, others wouldn't. [Go to F]
☐ Wouldn't evacuate. [Go to F]
☐ Don't know. [Go to F]
☐ Other. _____ [Go to F]

SCENARIO F. Now suppose the same hurricane is even closer, 12 hours away, and the Hurricane Center has continued its warning. Local officials are still ordering an evacuation.

15. What would you do?

- ☐ All in household would evacuate or probably would. [Go to Q16]
☐ Some would leave then, others wouldn't. [Go to Q16]
☐ Wouldn't evacuate. [Go to Q28 only if entire household.]
☐ Don't know. [Go to Q28 only if entire household.]
☐ Other. _____ [Go to Q28 only if entire household.]

16. Would everyone in your household who is evacuating go to the same place?

_____ Yes _____ No

17. Where do you think your group (and the other group) would go?

GROUP 1

- ☐ Friend's/Relative's
☐ Motel
☐ Public Shelter
☐ Other

GROUP 2

- ☐ Friend's/Relative's
☐ Motel
☐ Public Shelter
☐ Other

18. In what city and county is it (are they) located?

GROUP 1

GROUP 2

IF THE RESPONSE IS "PUBLIC SHELTER" OR "MOTEL" IN "MONROE COUNTY" THEN GO TO Q18a; OTHERWISE GO TO Q19.

18a. Do you realize that no public shelters or motels will be open in Monroe County during a Category III or a more severe hurricane?

_____ Yes _____ No

18b. Given this information, where do you think your group (and the other group) would go?

GROUP 1

GROUP 2

☐ Friend's/Relative's
☐ Motel
☐ Public Shelter
☐ Other

☐ Friend's/Relative's
☐ Motel
☐ Public Shelter
☐ Other

18c. In what city and county is it (are they) located?

GROUP 1

GROUP 2

19. What route(s) would be taken to get there?

GROUP 1

GROUP 2

20. How many people would probably be in the group(s)?

GROUP 1

GROUP 2

21. Taking into consideration how long it would take you to get ready to leave, when would you leave?

GROUP 1

GROUP 2

☐ Immediately
☐ Between 1 and 3 hours
☐ Between 3 and 6 hours
☐ 6 hours or more
☐ Don't know

☐ Immediately
☐ Between 1 and 3 hours
☐ Between 3 and 6 hours
☐ 6 hours or more
☐ Don't know

22. How many cars or other vehicles do you have at your household? _____

23. Would you be taking them when you evacuate?

GROUP 1

GROUP 2

☐ Yes

☐ Yes

☐ No

☐ No

How many?

24. Would you be pulling a trailer of any kind; boat, camper, etc.

☐ Yes

☐ Yes

☐ No

☐ No

☐ Maybe

☐ Maybe

25. Would you be taking a motorhome?

☐ Yes ☐ Yes
☐ No ☐ No
☐ Maybe ☐ Maybe

IF THE RESPONSE TO QUESTION 8 OR 17 IS "MOTEL" OR "PUBLIC SHELTER," GO TO QUESTION 26 OTHERWISE GO TO QUESTION 28.

26. You said you'd probably go to a motel or shelter. However, do you think there's a possibility that you might go to a friend's or relative's instead?

☐ Yes ☐ Yes [Go to Q27]
☐ No ☐ No [Go to Q28]
☐ Maybe ☐ Maybe [Goto Q27]

27. Where do they live? _____

28. Have you ever been in a hurricane threat?

☐ Yes [Go to Q28a]
☐ No [TERMINATE]

28a. Was it in the Keys?

☐ Yes ☐ No
 Where? _____

29. Which hurricane(s)?

☐ Cleo (1964)
☐ Donna (1960)
☐ Betsy (1965)
☐ Inez (1966)
☐ Floyd (1987)

Others _____

30. What did you do then?

Stayed.

Evacuated to:

Friend's/Relative's
 Motel
 Public Shelter
 Other

Hurricane 1
 (_____)

Name

Hurricane 2
 (_____)

Name

Hurricane 3
 (_____)

Name

If evacuated, where to?

Close: Thank you very much for your help. Goodbye.

APPENDIX C

SUMMARY OF RESPONSES TO THE FLORIDA KEYS SURVEY

1. What type of home or building do you live in?

	Upper	Middle	Lower	All
High rise condo or apartment 6 stories or greater	2.8%	0.0%	2.9%	1.9%
Low rise condo or apartment 5 stories or less	14.2%	15.0%	11.8%	13.6%
Single family home	53.8%	45.0%	64.7%	54.5%
Duplex or triplex	2.8%	14.0%	5.9%	7.5%
Mobile home	24.5%	21.0%	10.8%	18.8%
Other	1.9%	5.0%	3.9%	3.6%
	(n=106)	(n=100)	(n=102)	(n=308)

2. Is your home elevated?

	Upper	Middle	Lower	All
Yes	43.3%	46.0%	48.5%	46.2%
No	52.8%	50.0%	51.5%	51.5%
Not applicable	2.8%	4.0%	0.0%	2.3%
	(n=106)	(n=100)	(n=101)	(n=307)

3. A Category II hurricane of 100 mph winds is in the Caribbean or the Gulf moving toward the Keys and probably will not hit your area for 36 hours. A hurricane watch has been issued and local officials have only recommended a voluntary evacuation. Which of the following would you do?

All in household would evacuate or probably would.

Upper	Middle	Lower	All
42.5%	37.0%	19.6%	33.1%

Some would leave then, other wouldn't.

Upper	Middle	Lower	All
4.7%	4.0%	3.9%	4.2%

Wouldn't evacuate.

Upper	Middle	Lower	All
50.9%	57.0%	71.6%	59.7%

Don't know.

Upper	Middle	Lower	All
1.9%	2.0%	4.9%	2.9%

(n=106)	(n=100)	(n=102)	(n=308)
---------	---------	---------	---------

4. Suppose the same hurricane is closer, 24 hours away, and the Hurricane Center has issued a warning. Local officials have ordered an evacuation.

a. Of Total Sample:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
19.8%	25.0%	18.6%	21.1%

Some would leave then, others wouldn't.

Upper	Middle	Lower	All
1.9%	1.0%	2.9%	1.9%

Wouldn't evacuate.

Upper	Middle	Lower	All
29.2%	35.0%	57.8%	40.6%

Don't know.

Upper	Middle	Lower	All
6.6%	2.0%	1.0%	3.2%

(n=106)	(n=100)	(n=102)	(n=308)
---------	---------	---------	---------

b. Of Those Remaining:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
34.4%	39.7%	23.2%	31.6%

Some would leave then, others wouldn't.

Upper	Middle	Lower	All
3.3%	1.6%	3.6%	2.9%

Wouldn't evacuate.

Upper	Middle	Lower	All
50.8%	55.6%	72.0%	60.7%

Don't know.

Upper	Middle	Lower	All
11.5%	3.1%	1.2%	4.8%

(n=61)	(n=63)	(n=82)	(n=206)
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5. Suppose the same hurricane is even closer, 12 hours away, and the Hurricane Center has continued its warning. Local officials are still ordering an evacuation.

a. Of Total Sample:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
7.5%	3.0%	4.9%	5.2%

Wouldn't evacuate.

Upper	Middle	Lower	All
24.5%	32.0%	54.9%	37.0%

Don't know.

Upper	Middle	Lower	All
5.7%	3.0%	2.0%	3.6%

(n=106)	(n=100)	(n=102)	(n=308)
---------	---------	---------	---------

b. Of Those Remaining:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
20.0%	7.9%	7.9%	11.3%

Wouldn't evacuate.

Upper	Middle	Lower	All
65.0%	84.2%	88.9%	80.9%

Don't know.

Upper	Middle	Lower	All
15.0%	7.9%	3.2%	7.8%

(n=40)	(n=38)	(n=63)	(n=141)
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6. Would everyone in household who is evacuating go to the same place?

	Upper	Middle	Lower	All
Yes	96.2%	100%	100%	95.5%
No	3.8%			1.5%
	(n=78)	(n=68)	(n=50)	(n=196)

7. Where do you think your group would go?

	Upper	Middle	Lower	All
Friend/Relative	51.3%	44.1%	34.0%	44.4%
Motel	23.1%	26.5%	24.0%	24.5%
Public Shelter	5.1%	16.2%	32.0%	15.8%
Other	20.5%	13.2%	10.0%	15.3%
	(n=78)	(n=68)	(n=50)	(n=196)

8. In what city and county is it located?

	Upper	Middle	Lower	All
Miami, Dade	50.0%	33.8%	30.0%	39.3%
Homestead, Dade	11.5%	5.9%	0.0%	6.6%
West Palm Beach, Palm Beach	1.3%	2.9%	2.0%	2.0%
Ft. Lauderdale, Broward	5.1%	1.5%	0.0%	2.6%
Orlando, Orange	3.8%	2.9%	0.0%	2.6%
Monroe	11.5%	27.9%	46.0%	26.0%
Other city, Dade	2.6%	1.5%	0.0%	1.5%
Other city, other county, FL	9.0%	4.4%	8.0%	7.1%
Other city, outside FL	2.6%	4.4%	4.0%	3.6%
Other city, Palm Beach	0.0%	2.9%	0.0%	1.0%
Other city, Broward	0.0%	4.4%	4.0%	2.6%
Other city, Orange	0.0%	1.5%	0.0%	.6%
Other city, Pinellas	0.0%	2.9%	2.0%	1.5%
Don't know city, Dade	1.3%	0.0%	2.0%	1.0%
Don't know city, other co., FL	1.3%	1.5%	0.0%	1.0%
Don't know	0.0%	1.5%	2.0%	1.0%
	(n=78)	(n=68)	(n=50)	(n=196)

9. What route(s) would be taken to get there?

	Upper	Middle	Lower	All
U.S. 1	88.5%	86.6%	78.0%	85.1%
U.S. 1 & Turnpike	1.3%	3.0%	0.0%	1.5%
Card Sound Road	3.8%	0.0%	0.0%	1.5%
Local	2.6%	6.0%	20.0%	8.2%
By boat	1.3%	1.4%	0.0%	1.1%
By plane	0.0%	3.0%	2.0%	1.1%
Other/Don't know	2.6%	0.0%	2.0%	1.5%
	(n=78)	(n=67)	(n=50)	(n=195)

10. Taking into consideration how long it would take you to get ready to leave, when would you leave?

	Upper	Middle	Lower	All
Immediately	32.1%	34.3%	32.0%	32.8%
Between 1 and 3 hours	32.1%	32.8%	40.0%	34.4%
Between 3 and 6 hours	16.7%	20.9%	16.0%	17.9%
6 hours or more	2.6%	6.0%	8.0%	10.8%
Don't know	2.6%	6.0%	4.0%	4.1%
	(n=78)	(n=67)	(n=50)	(n=195)

11. A Category III hurricane of 120 mph winds is in the Carribean or the Gulf moving toward the Keys and probably will not hit your area for 36 hours. A hurricane watch has been issued and local officials have recommended a voluntary evacuation. Which of the following would you do?

All in household would evacuate or probably would.

Upper	Middle	Lower	All
50.9%	57.0%	29.4%	45.8%

Some would leave then, others wouldn't.

Upper	Middle	Lower	All
6.6%	9.0%	8.8%	8.1%

Wouldn't evacuate.

Upper	Middle	Lower	All
40.6%	33.0%	60.8%	44.8%

Don't know.

Upper	Middle	Lower	All
1.9%	1.0%	1.0%	1.3%

(n=106)

(n=100)

(n=102)

(n=308)

12. Suppose the same hurricane is closer, 24 hours away, and the Hurricane Center has issued a warning. Local officials have ordered an evacuation.

a. Of Total Sample:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
18.9%	14.0%	21.6%	18.2%

Some would leave then, others wouldn't.

Upper	Middle	Lower	All
0.0%	0.0%	1.0%	.3%

Wouldn't evacuate.

Upper	Middle	Lower	All
25.5%	28.0%	45.1%	32.8%

Don't know.

Upper	Middle	Lower	All
4.7%	1.0%	2.9%	2.9%

(n=106)

(n=100)

(n=102)

(n=308)

b. Of Those Remaining:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
38.5%	32.6%	30.6%	33.5%

Some would leave then, others wouldn't.

Upper	Middle	Lower	All
0.0%	0.0%	1.4%	.6%

Wouldn't evacuate.

Upper	Middle	Lower	All
51.9%	65.1%	63.9%	60.5%

Don't know.

Upper	Middle	Lower	All
9.6%	2.3%	4.1%	5.4%

(n=52)

(n=43)

(n=72)

(n=167)

13. Suppose the same hurricane is even closer, 12 hours away and the Hurricane Center has continued its warning. Local officials are still ordering an evacuation.

a. Of Total Sample:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
8.5%	5.0%	3.9%	5.8%

Some would leave then, others wouldn't.

Upper	Middle	Lower	All
0.0%	0.0%	1.0%	.3%

Wouldn't evacuate.

Upper	Middle	Lower	All
17.0%	22.0%	41.2%	26.6%

Don't know.

Upper	Middle	Lower	All
4.7%	2.0%	2.9%	3.2%

(n=106) (n=100) (n=102) (n=308)

b. Of Those Remaining:

All in household would evacuate or probably would.

Upper	Middle	Lower	All
28.1%	17.2%	8.0%	16.2%

Some would leave then, others wouldn't.

Upper	Middle	Lower	All
0.0%	0.0%	2.0%	.9%

Wouldn't evacuate.

Upper	Middle	Lower	All
56.3%	75.9%	84.0%	73.9%

Don't know.

Upper	Middle	Lower	All
15.6%	6.9%	6.0%	9.0%

(n=32) (n=29) (n=50) (n=111)

14. Would everyone in your household who is evacuating go to the same place?

	Upper	Middle	Lower	All
Yes	96.6%	98.8%	100%	98.3%
No	.3.4%	1.2%	0.0%	1.7%
	(n=87)	(n=81)	(n=64)	(n=232)

15. Where do you think your group would go?

	Upper	Middle	Lower	All
Friend/Relative	49.4%	46.9%	39.1%	45.7%
Motel	24.1%	29.6%	21.9%	25.4%
Public Shelter	5.7%	12.4%	29.7%	14.7%
Other	20.7%	11.1%	9.3%	14.2%
	(n=87)	(n=81)	(n=64)	(n=232)

16. In what city and county is it located?

	Upper	Middle	Lower	All
Miami, Dade	46.0%	34.6%	32.8%	38.4%
Homestead, Dade	11.5%	6.2%	0.0%	6.5%
West Palm Beach, Palm Bch	1.1%	2.5%	3.1%	2.2%
Ft. Lauderdale, Broward	4.6%	3.7%	1.6%	3.4%
Orlando, Orange	4.6%	4.9%	1.6%	3.9%
Monroe	12.6%	21.0%	34.4%	21.6%
Other city, Dade	2.3%	2.5%	0.0%	1.7%
Other city, Broward	2.3%	3.7%	3.1%	3.0%
Other city, Palm Beach	0.0%	2.5%	0.0%	.9%
Other city, Orange	0.0%	1.2%	0.0%	.4%
Other city, Pinellas	0.0%	3.7%	3.1%	2.2%
Other city, other county	9.2%	6.2%	10.9%	8.6%
Other city, outside FL	2.3%	3.7%	3.1%	3.0%
Don't know city, Dade	2.3%	0.0%	1.6%	1.3%
Don't know city, Other county, FL	1.1%	1.2%	0.0%	.9%
Don't know	0.0%	2.5%	4.7%	2.2%
	(n=87)	(n=81)	(n=64)	(n=232)

17. What route(s) would be taken to get there?

	Upper	Middle	Lower	All
U.S. 1	88.4%	91.1%	86.0%	88.7%
U.S. 1 & Turnpike	3.5%	2.5%	0.0%	2.2%
Card Sound Road	3.5%	0.0%	0.0%	1.4%
Local	1.2%	1.3%	7.0%	2.7%
By boat	1.2%	2.5%	0.0%	1.4%
By plane	0.0%	2.5%	3.5%	1.8%
Other/don't know	2.3%	0.0%	3.5%	1.8%
	(n=86)	(n=79)	(n=57)	(n=222)

18. Taking into consideration how long it would take you to get ready to leave, when would you leave?

	Upper	Middle	Lower	All
Immediately	29.9%	29.1%	25.9%	28.6%
Between 1 and 3 hours	31.0%	36.7%	43.1%	36.1%
Between 3 and 6 hours	19.5%	24.0%	12.1%	19.2%
6 hours or more	16.1%	5.1%	13.8%	11.6%
Don't know	3.5%	5.1%	5.1%	4.5%
	(n=87)	(n=79)	(n=58)	(n=224)

19. How many cars or other vehicles do you have at your household?

	Upper	Middle	Lower	All
1 vehicle	31.2%	42.1%	42.6%	38.1%
2 vehicles	46.2%	38.2%	40.7%	41.9%
3 vehicles	13.8%	13.2%	11.1%	12.9%
4 vehicles	8.8%	2.6%	5.6%	5.6%
5 vehicles	0.0%	1.3%	0.0%	.5%
8 or more vehicles	0.0%	1.3%	0.0%	.5%
No vehicles	0.0%	1.3%	0.0%	.5%
	(n=80)	(n=76)	(n=54)	(n=210)

20. Would you be taking them with you when you evacuate?

	Upper	Middle	Lower	All
Yes	100%	100%	100%	100%

a. How many?

1 vehicle	52	57	47	152
2 vehicles	22	12	5	39
3 vehicles	5	4	2	11
4 vehicles	1	0	0	1

21. Would you be pulling a trailer of any kind: boat, camper, etc.?

	Upper	Middle	Lower	All
Yes	10.0%	5.3%	3.9%	6.8%
No	86.3%	94.7%	94.1%	91.3%
Maybe	3.7%	0.0%	2.0%	1.9%
	(n=80)	(n=75)	(n=51)	(n=206)

22. Would you be taking a motorhome?

	Upper	Middle	Lower	All
Yes	1.3%	0.0%	0.0%	.5%
No	98.7%	100.0%	100.0%	99.5%
	(n=79)	(n=74)	(n=51)	(n=204)

23. Have you ever been in a hurricane threat before?

	Upper	Middle	Lower	All
Yes	92.5%	88.0%	93.1%	91.2%
No	7.5%	12.0%	6.9%	8.8%
	(n=106)	(n=100)	(n=102)	(n=308)

a. Was it in the Keys?

	Upper	Middle	Lower	All
Yes	73.5%	83.0%	83.2%	79.7%
No	26.5%	17.0%	16.8%	20.3%
	(n=98)	(n=88)	(n=95)	(n=281)

Hurricane:

	Upper	Middle	Lower	All
Cleo	8.2%	6.9%	8.4%	7.9%
Donna	20.6%	20.7%	20.0%	20.4%
Betsy	16.5%	19.5%	22.1%	19.4%
Inez	13.4%	9.2%	20.0%	14.3%
Floyd	57.7%	55.2%	63.2%	58.8%
David	14.4%	10.3%	2.1%	9.0%
Gilbert	2.1%	5.7%	10.5%	6.1%
Gloria	0.0%	1.1%	3.2%	1.8%
Other/don't remember	27.8%	43.7%	50.5%	40.5%

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